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THE CONVENTION SEASON.

This is the season of conventions, as well as that of commencements. On the one hand we have the students gathered together for the exercises which mark the termination of another year, and on the other we have the busy engineers and business men stealing a few days from their offices in order that they may renew old friendships, listen to papers prepared for their delectation, and, what is not the least important, enjoy for a short time freedom from the cares of the office. June is one of the best months for holding conventions. It is not too early for the summer resorts to be open, yet it is not so late that one need expect hot summer weather. But it is unfortunate for some of us that so many conventions should be held so close together. Those of us who are interested in several associations following different lines of work find it difficult, if not impossible, to attend as many of the meetings as we should like to.

THE INSTITUTE CONVENTION.

The twenty-second annual convention of the American Institute of Electrical Engineers held at Asheville, N. C., last week, will go down as one of the most enjoyable and successful meetings of recent years. Although the attendance at the convention was not as large as had been hoped, the attendance at the meetings was good, not only as to numbers, but because those present were particularly interested in the papers read.

When so many papers of exceptional value are read and discussed, it is difficult to pick out a few for special mention. The Institute has learned to depend upon Dr. C. P. Steinmetz for noteworthy papers. This year it was particularly fortunate in having two from his virile pen. The first was an interesting theoretical discussion of an actual happening—the interruption of one of the largest electrical supply systems in the world. It is an interesting fact that, although the paper was highly scientific and analytical, it is based upon the observations which the engineering staff made during tremendous occurrences and at a time when the operators knew that an extraordinary occurrence was going on that was shutting down their station, but which they were unable to prevent. That, during these trying moments, careful, accurate observation was made of what was going on speaks highly for the thorough organization of the operating staff of the Manhattan Railway Company, under Mr. H. G. Stott. Dr. Steinmetz's second paper described the application of the mercury-arc rectifier to arc lighting, which promises to be of much commercial value.

Another paper which attracted attention was that by Mr. Henry W. Fisher which gives a large amount of valuable data relating to electric conductors and cables. This paper was an innovation, as heretofore it has been the practice for manufacturing companies to treat such information as part of their stock in trade, and as such to be kept secret. It is being realized now that this policy is a mistaken one, and that to withhold from the constructing engineer such information merely reacts upon the manufacturer, for the engineer, if he does not understand the limitations surrounding the manufacturer of cables and conductors, is apt to set requirements which can not easily be met, or perhaps not met at all; and a failure is sure to be counted against the manufacturer.

Passing over the other papers read during the earlier meetings of the convention, which were all interesting and valuable, several of the papers read during the last session must be mentioned. Mr. P. N. Nunn described the development of the Ontario Power Company—that company which is carrying out the largest development on the Canadian side of Niagara Falls. Although, as Mr. Nunn pointed out himself, his company can not take the credit which is due to the pioneers in the development of the Niagara power, those who listened to his paper

seemed to feel that too much praise could not be given for the manner in which this gigantic work has been planned and is being carried out. It is hard to realize that fifteen years ago a 100-kilowatt generator was an enormous machine, and a station which could boast three or four such machines was viewed with wonder. Yet to-day we have a power station in course of erection which will contain twenty generators, each rated at 10,000 horse-power. We talk of thousands of kilowatts now, where we talked of one before.

The paper read by Mr. Stanley, describing a new induction generator, opens a field of wide possibilities. The machine described appears to be an alternator having a perfect regulation, since it can be adjusted to give any kind of load characteristic for any kind of load. Besides being interesting from this point of view, the machine is unique in that it is possible not only to control the voltage of the machine and its regulation, but the frequency can also be varied without changing the speed of rotation.

Another noteworthy paper read during this meeting was that in which Mr. John W. Howell described a new carbon filament for incandescent lamps. The new filament appears to have a high efficiency and long life. As was remarked in the discussion, it is the reply of carbon to its new competitors.

A fourth noteworthy paper read was that by Dr. F. A. C. Perrine, on "Water Powers of the Southern Appalachian Region." This paper was particularly appropriate, since it not only brought to the attention of those present the resources of a large and growing section of the country, but it dealt with the country in which the meeting was being held.

For such an excellent selection of extremely valuable papers due credit must be given to the Institute's committee on papers. Seldom, if ever, has such an excellent programme been arranged. President Lieb must also be much commended for the manner in which the meetings were handled. Rarely are so many papers of interest presented and discussed so satisfactorily as was the case at Asheville. This is due largely to the concise abstracts which President Lieb insisted upon. It suggests that even greater success might be attained if the authors were not allowed to read any part of the paper, presenting merely verbal abstracts.

The social side of the convention was no less successful than the business side. The local committee did everything in its power to ensure to the visitors an enjoyable time. Asheville, as is well known, is beautifully located in the mountains, and the visitors were taken on many charming trips to the neighboring points of interest. It is hard to say which was enjoyed the most—the drive through Biltmore, the trip through the Toxaway country, or the complimentary banquet. Asheville evidently has had a wide experience in taking care of conventions; it extended every possible courtesy to its visitors, and from Mayor A. S. Barnard down, every citizen seemed to have the success of the convention at heart. The Asheville convention has established a record for important work well done, and many pleasures well enjoyed.

HIGH-SPEED RAILROADING.

A natural consequence of the unfortunate wreck of one of the eighteen-hour trains between New York and Chicago, following so soon after the schedule had been put in force, was that the president of the road put the train back on the twenty-hour schedule until a thorough investigation of the cause of the accident could be made. From this it appears that the wreck was not due to the high speed of the train, and this conclusion has been followed by a return to the eighteen-hour schedule.

It seems that the accident was due to a misplaced switch, though how this happened to be so has not been explained. Under these conditions, any fast train would suffer the same fate, and it is certainly possible that the train, under the twenty-hour schedule, had on many occasions made this particular piece of running at a higher speed than the eighteen-hour train was making at the time it was wrecked. In fact, it is said that forty-five minutes before the passing of the flier another train, making no attempt at rapid speed, had passed the same switch going faster.

Commenting upon this accident, the New York *Sun* speaks as follows:

The deplorable accident on Wednesday to one of the very fast trains between New York and Chicago was due to a cause which would bring destruction to any train, fast or slow, a maliciously open switch.

Contrary to popular notion, a very fast train is usually a very safe train. A cheaply built road, without modern service improvements, may carry trains going at ordinary speed with entire safety, but to run record-breaking trains on them would be impracticable. To attain record speed it is necessary that every requirement of progressive railroading shall be fulfilled. The steel rails must be heavy and well tempered; the joining at the flanges or sockets must be perfect; the ties upon which the rails rest must be of hard wood which will not give, warp or sag; the foundation of the roadway must be firm and the ballast substantial and well set. There must be slight grades and few curves; engines must be heavy, the cars strong and the coupling perfect. Only on such a road can really fast time be made, and the stability of the roadbed and equipment reduces to a minimum the dangers of accident from causes other than those arising from an open switch, an encumbrance on the track, an accident to the engineer or the work of a train wrecker. No amount of careful, expensive railroad building or of careful management can eliminate all danger from travel.

The great majority of accidents, in proportion to the number of passengers carried, are on the older, smaller or less improved roads; the smaller number occur on the trunk lines.

It is true that a very fast train is usually a very safe train. The mere fact that a train is running at an unusual speed does not imply that it is incurring unusual danger. On the other hand, while all ordinary precautions are observed by our railway companies, they should realize that when extraordinary speeds—extraordinary merely as compared with the ordinary running schedules—are maintained, extraordinary precautions must be taken. No doubt this is true of the section of road on which the wreck occurred, and the officials in charge believed that they had eliminated all possible danger; but that

such an accident was possible suggests that there must be some way of preventing its happening again. An extension of the automatic block signal system should be made which would warn the locomotive engineer at any time of a misplaced switch or broken rail.

Another phase of the accident should not be lost sight of. It is stated that none of the deaths was due directly to the shock of the wreck, but all were caused by the fire which broke out immediately. This is a strong argument not only for fireproof cars, but for the prohibition of inflammable materials on passenger trains.

STEAM TURBINE PERFORMANCE.

Following closely upon our comment on the excellent showing made by a Westinghouse-Parsons turbine installed at the Westinghouse Machine Company at East Pittsburg, Pa., our attention has been called to a recent test of a De Laval steam turbine of 150 horse-power which has been running for some two years at the plant of the New England Structural Company at East Everett, Mass. The maker's guarantee on this machine was 18.7 pounds of steam per brake-horse-power-hour, at full load, and 19.7 pounds of steam per brake-horse-power-hour, at half load, with 150 pounds steam pressure at the governor valve, and twenty-six inches vacuum at the turbine. After two years running, upon test, the steam consumption was 17.77 pounds per brake-horse-power-hour, with the steam pressure 152.9 pounds at the boiler and 145.9 below the governor and a vacuum of 25.47 inches—well within the original guarantee. The construction of the buckets in this type of machine is slightly different from the vanes of the Westinghouse-Parsons. However, as was the case with the latter, the buckets and wheel, and also the pinion, showed no effects of wear.

In this connection, too, the paper presented by A. S. Mann before the Scranton meeting of the American Society of Mechanical Engineers is of considerable interest. With the advent of the steam turbine with its sensitive discs, rotating at high velocity, in steam-tight chambers, there was much speculation concerning the behavior of the discs with rapid changes of temperature and unequal expansion. It was easy to imagine difficulties with a rapid start.

Mr. Mann describes a plant equipped with three Curtis turbines, each driving a 1,500-kilowatt alternator. This plant operates as an auxiliary to a hydraulic equipment, taking all sudden overloads. Careful organization of the working forces brings about the manipulation of starting all the apparatus auxiliary to the turbine simultaneously with opening the throttle valve to the turbine steam chamber. Only a few seconds elapse between starting the first pump and starting the first turbine. Manipulating the engine regulator so that it will be at a precise speed and at an exact phase relationship with another machine is a matter which should not be hurried, but the whole thing, phasing-in and all, says the author, has been done in two and one-half minutes, including full load on the turbine which started from a standstill. Out of forty-three such calls the record-book shows that ten starts were made in two and one-half minutes; eighteen in three minutes, and fifteen in three and one-half minutes.

SOME GOOD SUGGESTIONS.

As a topic for the annual presidential address delivered during the Asheville convention, President John W. Lieb, Jr., of the American Institute of Electrical Engineers, took the organization and administration of the engineering societies. President Lieb's experience during his year of office has shown him that certain changes in the organization of the American Institute of Electrical Engineers are desirable; and by making a comparative study of its constitution and those of the three other national engineering societies, he shows wherein the latter may be better than the former, and makes a number of important suggestions.

Probably the most important phase of the situation at present confronting the Institute is the rather restricted geographical distribution of members. This, in a way, can not be helped, as the larger cities naturally draw to themselves important engineering establishments, and there the consulting engineers find it most advantageous to locate. But unfortunately such a condition tends to become accentuated and until ex-President Scott started the establishment of local sections at different points, it was felt in many quarters that the Institute was a rather local affair. One of the benefits of the local sections is that they are bringing about a change in feeling in this regard as well as interesting the younger members in the Institute. But the suggestions made by President Lieb will be a further help in making the Institute the great electrical association of the entire country. While it is true that it will be more troublesome to carry on the government of the society when the officers are selected from widely separated districts, this disadvantage is of little moment compared with the gain which will come to the Institute when all the electrical engineers, north, south, east or west, are equally interested in its welfare.

The suggestions made as regards an increase in dues are timely. The Institute can not meet properly the great responsibilities which it has accepted unless it has better financial support. As compared with the other societies, the dues are about the average, but the entrance fee is small and when the rooms in the new engineering building are occupied it will only be proper, as President Lieb says, for the members in and about New York to pay more for the benefits which they will enjoy.

The suggestion that a new class of members should be formed should receive the careful consideration of the board of directors. It is annoying, to say the least, to men who have become eminent through their work, but who, because this does not lie along one of two specified lines, are debarred from full membership and kept down with the young man who has just graduated from college, or who perhaps has not even received a degree. It is to be hoped that President Lieb's admirable address will be carefully considered by the board of directors, and that at its next meeting it will take such action as will best carry forward the interests of the Institute.

National—Interstate Telephone Association.

First Annual Convention, Held in Chicago, Ill., June 20, 21 and 22.

THE first annual convention of the National-Interstate Telephone Association was called to order by James B. Hoge in the Auditorium, June 20, at 10.30 A. M.

TUESDAY MORNING SESSION.

Mr. Hoge introduced Colonel J. D. Powers, of Louisville, Ky., who had been selected to act as temporary chairman. After announcing the preliminary order of business, Colonel Powers introduced City Prosecutor Taylor, who, on behalf of Mayor Dunne, welcomed the delegates to the city of Chicago.

Colonel Powers called upon the Honorable S. P. Sheerin, of Indianapolis, to respond. Mr. Sheerin began his address in the most happy fashion, but had only been speaking for a minute when he staggered and fell. Colonel Powers caught him, and immediately summoned medical assistance. When a physician arrived he pronounced Mr. Sheerin dead from a stroke of apoplexy.

The convention immediately adjourned until three o'clock.

TUESDAY AFTERNOON SESSION.

Colonel Powers called the convention to order and announced A. L. Tetu, of Nashville, Tenn., as temporary secretary, with C. H. Wells, of Marion, Kan., and H. E. Bradley, of Philadelphia, Pa., as assistant secretaries.

A motion was made by Mr. Hoge, upon the suggestion of the chairman, that a committee of ten be appointed to draft resolutions and take any other proper action upon the death of Mr. Sheerin.

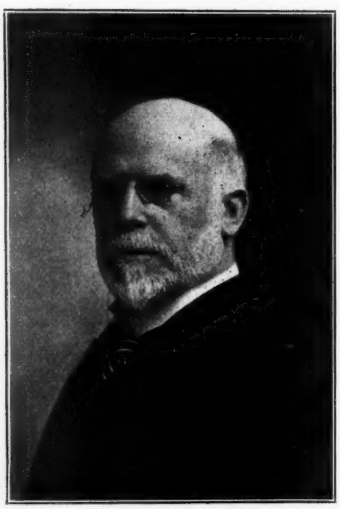
The committee was appointed as follows: Jesse W. Weik, Indiana, chairman; J. G. Splane, Pennsylvania; J. B. Ware, Michigan; George W. Beers, Indiana; E. B. Fisher, Michigan; E. L. Barber, Ohio; E. E. Clement, Washington, D. C.; James B. Hoge, Ohio; Theodore Gary, Missouri; J. D. Powers, Kentucky.

The following committee on amendments to the constitution was appointed: Theodore Thorward, Indiana; H. A. Price, Michigan; E. W. Dunnaway, Texas; W. C. Thompson, Ohio; P. T. Spencer, California.

The committee on credentials was appointed as follows: J. G. Splane, Pennsylvania; Richard Valentine, Wisconsin; J. S. Bellamy, Iowa; G. M. Saltzgaber, Ohio.

Colonel Powers called for a presentation of delegates from each state for representation on the nominating committee. The following were nominated by the various states to serve on this committee: Stanley S. Lichty, Iowa; W. Roy McCanne, Missouri; W. Gilbert Thompson, Ohio; E. B. Fisher, Michigan; J. C. Harper, Wisconsin; Charles K. Wells, Kansas; P. Kerr Higgins, California; A. C. Davis, West Virginia; H. K. Cole, Kentucky; S. B. Rawson, New York; W. L. Moellering, Indiana; E. W. Dunnaway, Texas; N. R. Conklin, Illinois; W. H. Bryant, Alabama. E. E. Clement was elected by the convention to represent the District of Columbia.

E. L. Barber moved that a committee of five be appointed to meet a like committee of manufacturers to discuss kindred relations.



THE HON. S. P. SHEERIN.

The motion was seconded and carried. Upon this committee, the chair appointed E. L. Barber, Ohio; J. G. Splane, Pennsylvania; Richard Valentine, Wisconsin; C. Y. McVey, Ohio; O. C. Snider, Missouri.

It was moved and seconded that on the next day all the regular business of the convention be taken up, the banquet and other entertainment features to be abandoned.

The session adjourned to meet at 9 A. M. the following day.

WEDNESDAY MORNING SESSION.

The morning session opened promptly at nine o'clock, with Colonel Powers in the chair. The committee reported through Jesse W. Weik the resolutions upon the death of the Hon. S. P. Sheerin, as follows:

The sad and untimely death in this hall yesterday of the Hon. S. P. Sheerin, president of the New Long-Distance Telephone Company, of Indianapolis, has cast a deep and melancholy shadow over the otherwise auspicious proceedings of this the ninth annual convention of the independent telephone interests and the first annual meeting of the National-Interstate Telephone Association of the United States.

The sudden and tragic taking off of our brother only serves to emphasize the truth of the adage that death loves a shining mark. In the entire field of telephony, a more conspicuous champion of the independent movement, a more zealous laborer for our common cause and mutual good, could not have been found. He knew no season. At all times and in all places he proved his devotion to our dearest and best interests; and so faithful and unremitting were his efforts, it may truthfully be said he died in harness—in the very act of appealing to the greatest constituency on earth, the American people, for our just rights and a square deal.

He was a man of fertile resources and deep usefulness. The son of a mechanic and himself a laborer over the anvil, in his father's shop, he early demonstrated his skill and ability. His associates and neighbors, impressed by his faithfulness and worth, chose him to fill one of the important offices, that of recorder in Cass County, Ind. From that he was promoted to the more noteworthy position of clerk of the Supreme Court of Indiana. But meanwhile his reputation had grown beyond the confines of his state, and in 1888 he was selected and served until 1896 as the secretary of the Democratic national committee. In whatever station he occupied, to whatever post he was chosen, he demonstrated that he was in every case equal to the demand. His rise in and his successful civic career are admirable illustrations of the great possibilities that lie within the reach of the American youth endowed with a clear head, a brave heart and a strong right arm.

His private life was clean. His habits were above reproach. Always genial and affable, he was none the less, when occasion demanded it, brave, assertive and tenacious. He was generous and forbearing, and his heart overflowed with sympathy for others whom sorrow or misfortune had overtaken. But above all things he was loyal and true. Once admitted to his friendship, he bound you with bands of steel. Nothing could make him do a dishonest act or join with others in a questionable transaction. He held that the faith and trust of his friends were dearer to him than money or any kind of preferment.

In his death independent telephony has suffered an overwhelming and incalculable loss. Were he living he would still be with us shoulder to shoulder in the great struggle for fair competition and clean, wholesome business methods.

The convention having been adjourned over yesterday out of respect for the memory of the deceased, therefore be it

***Resolved*, That copies of this memorial be entered on the records of the association and furnished to the sorrowing and bereaved family.**

Colonel Powers then delivered his address calling attention to the present status of the independent companies, and the need for a strong central organization.

E. B. Fisher, of Grand Rapids, arose

and suggested that inasmuch as the late James M. Thomas, formerly of Chillicothe, Ohio, the first president of the association, had died since the last formal meeting of the association, that a committee should be appointed to prepare suitable resolutions.

The following committee was appointed: E. B. Fisher, Michigan; Dwight E. Sapp, Ohio; B. G. Hubbell, New York; G. W. Beers, Indiana.

The nominating committee presented its report, which was unanimously ratified, as follows:

President, James B. Hoge, Cleveland, Ohio.

First vice-president, Theodore Gary, Macon, Mo.

Second vice-president, John Van Liew, Los Angeles, Cal.

Secretary, A. L. Tetu, Nashville, Tenn.

Treasurer, J. G. Splane, Pittsburg, Pa.

Executive committee: W. D. Barnard, Pennsylvania; E. L. Barber, Ohio; Colonel J. D. Powers, Kentucky; Theodore Gary, Missouri; John Van Liew, California; Geo. W. Beers, Indiana; Richard Valentine, Wisconsin; Chas. C. Deering, Iowa.

Mr. Hoge is one of the most widely known men in the field of independent telephony. He is secretary of the United States Long-Distance Telephone Company, operating in the central states, and of the Cuyahoga Telephone Company, of Cleveland, Ohio. He is also a prominent member of the so-called conference committee which has in charge the wide extension of independent long-distance lines throughout the country. He was the former president of the National Telephone Association, having been elected last fall at St. Louis, Mo. Mr. Hoge is, while one of the oldest men in the harness in independent telephony, one of the youngest in point of years. He started in life as a telegraph operator for the Cleveland, Lorain & Wheeling Railroad, and from there went into the banking business and then into the telephone field.

Mr. Gary was the former president of the Interstate Telephone Association. Mr. Van Liew is one of the most prominent independent operators on the Pacific coast, and Mr. Tetu is prominently identified with the development of the South. The treasurer, Mr. James L. Splane, is president of the Pittsburg & Allegheny Telephone Company, of Pittsburg.

The papers at the morning session, by Mr. A. B. Greenshields, a well-known investment banker and broker of Philadelphia, on "Independent Telephone Securities," and on "Standard Toll Signs," by W. F. Laubauch, of Akron, Ohio, were read and discussed.

WEDNESDAY AFTERNOON SESSION.

The early part of the afternoon session was devoted to the roll call of states, at which time delegates representing the

JAMES B. HOGE, PRESIDENT OF THE NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

different states made reports to the convention upon telephone conditions in the independent movement. These reports showed a uniformly healthy condition with gains in many communities.

The following resolution was offered by E. K. Clement, of Washington, D. C.:

WHEREAS, Mr. Samuel G. McMeen, of Chicago, was requested, among others, to prepare a paper for presentation to this

THEODORE M. GARY, FIRST VICE-PRESIDENT NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

convention on the subject of composite transmission, or the use of telephone lines for the telegraphic work, a subject of great importance because the said use affords a means for directly increasing earnings without correspondingly increasing expense; and

WHEREAS, Mr. McMeen, at the cost of much valuable time, prepared this paper, with elaborate charts, for oral presentation to the association this morning, which presentation was unfortunately prevented by lack of time owing to press of other matters; now therefore,

Resolved, That the association appreciates very highly the efforts of Mr. McMeen, and in thanking him, regrets its deprivation in not listening to his forceful and always lucid delivery.

It recommends all members to read with care the article in the reports, and instructs the secretary to record this resolution, communicating a copy thereof to Mr. McMeen.

The committee appointed at the morning session to draft resolutions on the death of Judge Thomas, presented the following through Dwight E. Sapp, of Mt. Vernon, Ohio:

Resolved, That this assembly, representing as it does our entire country, deeply feels the loss sustained by the independent telephone interests in the death of Judge J. M. Thomas;

Resolved Further, That this occasion and this assembly, national in its character and scope, affords a fit and proper medium through which to perpetuate our regard and esteem for the deceased, and to transmit to his widow and children, in permanent form, evidence of the existence of these sentiments;

Resolved Further, That these resolutions be spread upon the minutes of this meeting, and that a copy thereof be forwarded by the secretary to the widow of the deceased.

Through representatives and by correspondence the following cities extended invitations to the convention to have the ninth annual meeting of the association: Atlantic City, N. J.; Nashville, Tenn.; Cleveland, Ohio; Niagara Falls, N. Y.; Detroit, Mich.; Put-in-Bay, Ohio.

Before adjourning, the convention decided unanimously to put into effect at once a strong central organization on behalf of all the independent operating companies forming the association. The president and executive committee were authorized to go ahead and effect such an organization and employ such assistance as might be deemed advisable. The expenses of this organization will be borne by special contributions and by assessments upon the several companies comprising the association, the assessment not to exceed one cent per telephone per year.

The fight over the standardization of toll signs was carried on the floor of the convention, and after a spirited but friendly contest it was decided to retain the red, white and blue shield sign, which was adopted some time ago by the conference committee of the long-distance companies. There was a feeling that the shield should be retained, but only printed in two colors—blue and white—but an overwhelming majority of the delegates present favored the red, white and blue.

The executive committee, it is stated,

will make arrangements immediately for the opening of headquarters for the press, for the collection, preparation and dissemination of news of general interest to all the independent companies throughout the country so that they may conduct their business with full knowledge of the conditions and successes which attend the efforts of their associates. In this connection an advertising bureau will be instituted whose province it will be to prepare suitable advertising of a general nature and applicable to the needs of the different members of the association.

The convention adjourned *sine die*. The next meeting-place will be decided upon by the executive committee, upon call of the president.

MANUFACTURERS, EXHIBITS AND REPRESENTATIVES.

The manufacturers, as usual, contributed largely to the success of the convention with elaborate exhibits, over fifty companies showing their products, and having on hand in each case a corps of representatives for the instruction and entertainment of visitors.

A number of manufacturers (among which were the following) distributed souvenirs:

National Carbon Company, Cleveland, Ohio, a flash light.

Kellogg Switchboard and Supply Company, the Swedish-American and the Central Electric Company, watch fobs.

Miller Anchor Company, Norwalk, Ohio, a miniature anchor.

F. Bissell Company, Toledo, Ohio, a scarf pin showing its trade-mark "Frog."

Morgan & Wright, Chicago, Ill., a souvenir programme of the convention in the shape of a receiver.

The Kellogg Switchboard and Supply Company, while not exhibiting, had three automobiles making trips to its factory; a large number of the delegates took advantage of this opportunity of enjoying an automobile ride and at the same time seeing this company's extensive plant.

The Electrical Appliance Company furnished tickets of admission to the "White City," also admission to the fire show in the "White City"; a very large number used these tickets Wednesday evening and the delegates were delighted in seeing the Electrical Appliance Company's wagon being driven around the fire show, and one of the buildings had a large sign advertising this company's line of telephone and electric supplies.

American Electric Supply Company, Chicago, Ill., had an exhibit which attracted a great deal of attention, showing a complete line of telephone supplies. Among the supplies exhibited were the American dry cells and the Blake insulated staples. Mr. F. D. Phillips, general manager; E. J. Johnson and W. R. Price represented the company.

The Denio General Electric Company, Rochester, N. Y., was represented by G. Babcock, consulting engineer, and J. A. Nolan. The company exhibited a new telephone fire-alarm system.

The Automatic Electric Company, Chicago, Ill., in addition to its well-known automatic switches and wall instruments, exhibited a new four-party line system, with lockout and selective ringing. The company was represented by J. F. Crook, H. S. Durant, A. J. Rosseau, and C. L. Fisher, of the sales department, and H. H. Woodworth, advertising manager, and A. Skaloski, of the engineering department.

The Standard Underground Cable Company, Pittsburg, Pa., was represented by J. R. Wiley, Chicago, western manager; E. J. Pietzcker, St. Louis, Mo., southwestern manager; I. E. Hughes, Philadelphia, southeastern manager; W. M. Rogers, Chicago; J. E. O'Neill, Chicago.

The Eureka Electric Company, Genoa, Ill., exhibited a complete line of its latest telephone equipment, including a new self-restoring drop switchboard and new style telephones.

The Century Telephone Construction Company, Buffalo, N. Y., exhibited its four-party selective system, platinum electrode transmitters, automatic signaling instrument, combination relay, cableheads and other appliances. The company was represented by G. F. C. Bauer, manager of the sales department; W. W. Kidney, chief engineer; Lloyd E. Knapp, western representative, and H. L. Grant, Indiana representative.

Frank B. Cook, Chicago, Ill., manufacturer of protective apparatus, exhibited several new things in the line of self-soldering protectors and pole-cable terminals. In charge of the exhibit were F. W. Pardee, general manager; F. R. Parker, G. C. Fricke, James Strasburg, M. A. Gurney, C. C. Newburg, F. A. Rader and H. R. Cook.

The Sterling Electric Company, Lafayette, Ind., had on exhibition a large variety of apparatus. The company was represented by W. E. Doolittle, president; W. R. Coffroth, secretary and treasurer; G. W. Metcalfe, salesman; S. B. Fowler, electrical engineer; H. T. Doolittle, purchasing agent; G. S. Montfort, salesman; E. S. Shelby, sales manager; E. C. Clay, salesman, and H. W. Mower, salesman.

The North Electric Company, Cleveland, Ohio, exhibited a 100-line multiple switchboard, a number of complete small switching stations, ringers and switchhooks and other apparatus. The company was represented by Charles H. North, president; I. J. Kusel, western sales representative; George B. Pratt, David Gibson and C. E. Boyd.

Among other exhibitors were the following:

Ackerman-Boland Telephone Company, Chicago.

American Conduit Company, Chicago.

American Electric Telephone Company, Chicago.

American Electric Fuse Company, Chicago.

American Steel and Wire Company, Chicago.

Austin, M. B., & Company, Chicago.

Baird Manufacturing Company, Chicago.

Chicago Telephone Supply Company, Elkhart, Ind.

Chicago Writing Machine Company, Chicago.

Conover, Geo. W., Chicago.

Crumb, W. H., & Company, Chicago.

Dean Electric Company, Elyria, Ohio.

Edwards-Hine Company, Grand Rapids.

Electric Appliance Company, Chicago.

Electric Gas Lighting Company, Boston.

Ewing-Merkle Electric Company, St. Louis.

Farr Telephone and Construction Company, Chicago.

Fibre Conduit Company, Orangeburgh, N. Y.

Fisk-Newhall Telephone Manufacturing Company, Chicago.

Haller Machine Company, Chicago.

Illinois Electric Company, Chicago.

Monarch Telephone Manufacturing Company, Chicago.

Monarch Electric and Wire Company, Chicago.

Moon Manufacturing Company, Chicago.

National Battery Company, Buffalo.

Nicholas Selective Telephone Company, Rochester, N. Y.

Raber & Watson, Chicago.

Reynolds-Dull Flasher Company, Chicago.

Rock Island Battery Company, Rock Island, Ill.

Standard Telephone and Electric Company, H. M. Eldred, manager.

Stromberg-Carlson Telephone Manufacturing Company, Rochester.

Swedish-American Telephone Company, Chicago.

T. & A. Selective Call Company, Geneseo, Ill.

The Lindsley Brothers Company, Chicago.

Turner Brass Company, Chicago.

Vought-Berger Company, LaCrosse, Wis.

Waterbury & Company, New York.

D. C. West, Cleveland.

Western Steel Gate Company, Two Rivers, Wis.

Western Telephone Manufacturing Company, Chicago.

Williams Telephone and Supply Company, Cleveland.

High Power Gas Engines in Electric Power Plants of German Ironworks.

By Frank C. Perkins.

THE accompanying illustration, Fig. 1, shows a new tandem double-acting gas engine of 1,200-horse-power capacity driving an electric generator at the Dillingen Iron Works at Dillingen-on-the-Saar. Each of the two cylinders of this engine measures 900 millimetres in diameter, the stroke being 1,100 millimetres in length. This engine operates at a speed of 100 revolutions per minute. It was constructed by Ehrhardt & Schner, of Schleifmuhle, Post Saarbrucken, Germany. Fig. 2 shows a similar engine of 700-brake-horse-power capacity. At the power-house of the Halberger Iron Works at Brebach a. d. Saar, there is a double-cylinder engine of the double-acting type of similar construction, although the cylinders are not connected in tandem, but in parallel as shown in Fig. 3. This engine has a capacity of 650 brake-horse-power and is direct-connected to a multipolar continuous-current generator, driving the same at a speed of 150 revolutions per minute. The two cylinders of this engine each has a diameter of 660 millimetres, the stroke being 800 millimetres.

These large gas engines are constructed on the well-tried four-cycle principle, the complete cycle taking place on each side of the piston.

There is an explosion every revolution in the single-cylinder engine on this principle, while in the case of the double cylinder of either tandem or parallel construction an impulse takes place every stroke, or, in other words, there is a continuous turning moment on the crank-shaft. While the engine is arranged with the cylinders tandem, the unexploded gases are used as a cushion to the inertia of the moving parts in exactly the same way as in a single-cylinder steam engine.

There is a slight advantage as regards accessibility of gear with the parallel design. In cases of absolute necessity it can be run as a single-cylinder engine, while this can only be done with difficulty with the tandem design. In an engine with four cylinders arranged tandem and parallel the advantages of both systems are combined and this design is highly advantageous where large power is required, and exceptionally even working is attained. These engines are said to be specially suitable for electrical power generation, owing to the heavy flywheel in conjunction with the sensitive and steady governor used, and are also well suited

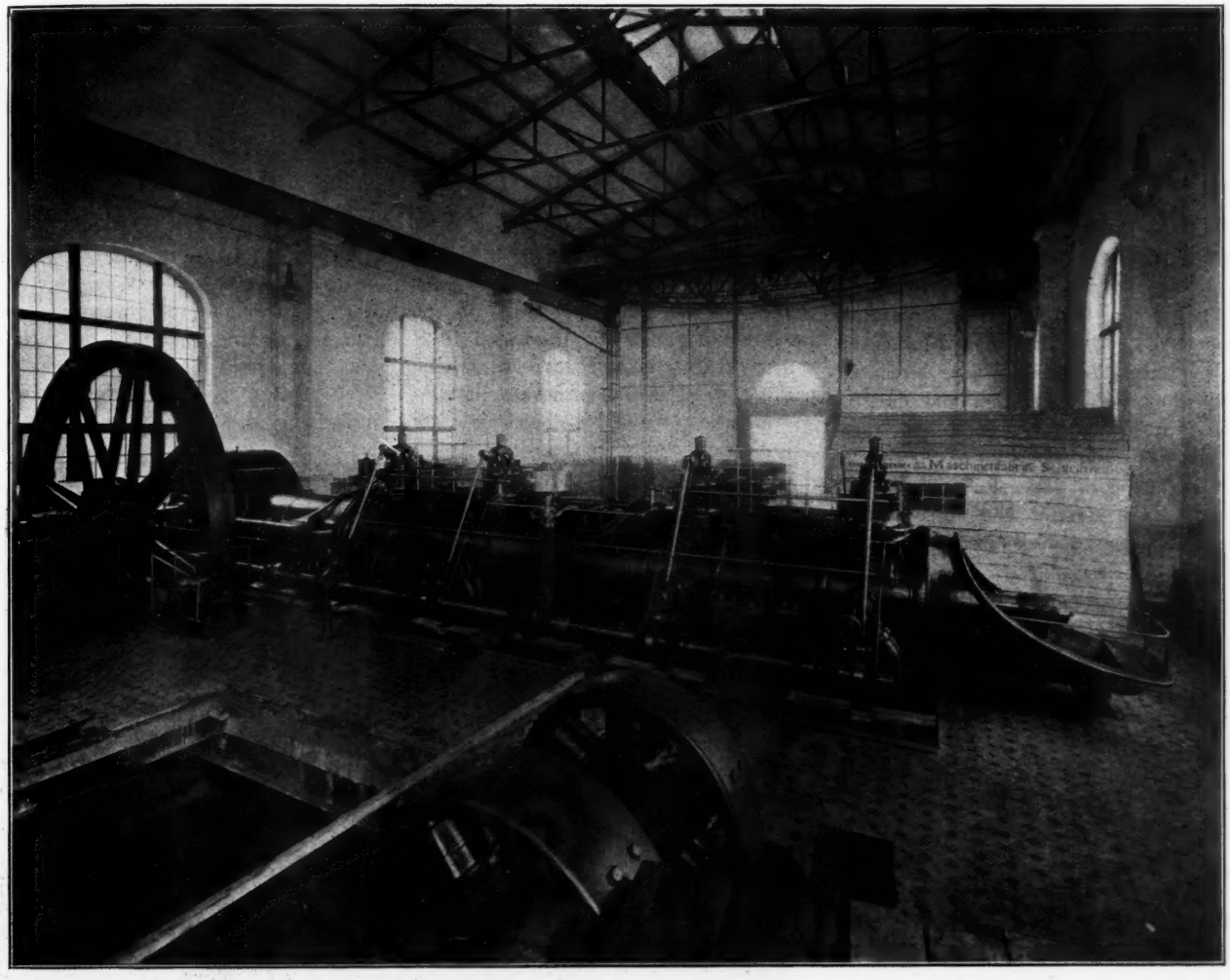


FIG. 1.—1,200-HORSE-POWER, DOUBLE-ACTING, TANDEM GAS ENGINE, DRIVING GENERATOR AT THE DILLINGEN IRON WORKS.

to driving high-speed direct-coupled pumps, either coupled to the back end of the piston-rod or direct to the crank-shaft. Also the combination for blast-furnace work, of a blowing cylinder coupled in the former manner and fitted with special air valves, has proved very efficient, giving a mechanical efficiency of eighty-one per cent in the air cylinder.

The cylinder being the most important element of the machine, the greatest care and attention is said to have been expended on its construction and design. The cylinder and water-jacket are cast in one piece and so arranged that some of the stresses on the cylinder walls are taken by the jacket. The water-cooling space is large and care has been taken to make all parts accessible and to render cleaning and inspection easy.

There is said to be no chance of warping, internal strains or vibration, the whole design of the engine tending to prevent these, as the chief working stresses in the engine are absolutely evenly divided and parallel to the main axis of the cylinder. The experience of this firm in building high-pressure pumps has been of great service to it in designing the cylinder openings, great care being taken in the cooling of their junctions with the cylinder walls. The covers are the same, back and front, and as the diameters of the distance piece, frame and back guide connection are larger than the flanges of the cylinder covers, these latter can easily be moved along the piston-rod, thus allowing easy inspection or the removal of the piston at either end of the cylinder. The cross-head guide is open at the top.

The piston is made very light and is cast in one piece from cast iron and is fitted with self-expanding cast-iron rings. The construction of the piston is such that the lubricant is distributed evenly to the cylinder walls. A piston-rod carries the piston, this being guided and supported at both ends of the cylinder. Both piston and rod are internally water-cooled, the water being introduced through an axial boring in the piston-rod and carried away in the same manner. This cooling has proved to be most efficient and in spite of protracted running it is said that it is not necessary to adjust the stuffing-box glands which are fitted to the water circulation. The piston-rod itself is fitted at the stuffing-boxes with metallic packing, which is free to move radially.

The back guide and distance piece are designed to allow the easy removal of the cylinder covers, which are also fitted with slides on which work slide blocks carrying the weight of piston and piston-rod.

The valve gear was designed for a constant mixture ratio between gas and air with whatever load the engine was running under, so as to reduce the reaction on the governor as much as possible. To attain this the German engineers arranged that there should be a main-inlet valve with a constant lift, while the governing of the charge should be effected by means of a special mixture or regulating valve, the area of the passage through this valve being controlled by the governor in such a manner that at any load the ratio of gas to air should remain nearly constant. This ensures reliable ignition, however small the charge may be, and a very low consumption of gas at any cut-off. The ratio of the mixture can be varied quickly within wide ranges, according to the quality of the gas being used, without any difficulty or special apparatus, and without throttling the total charge, so that

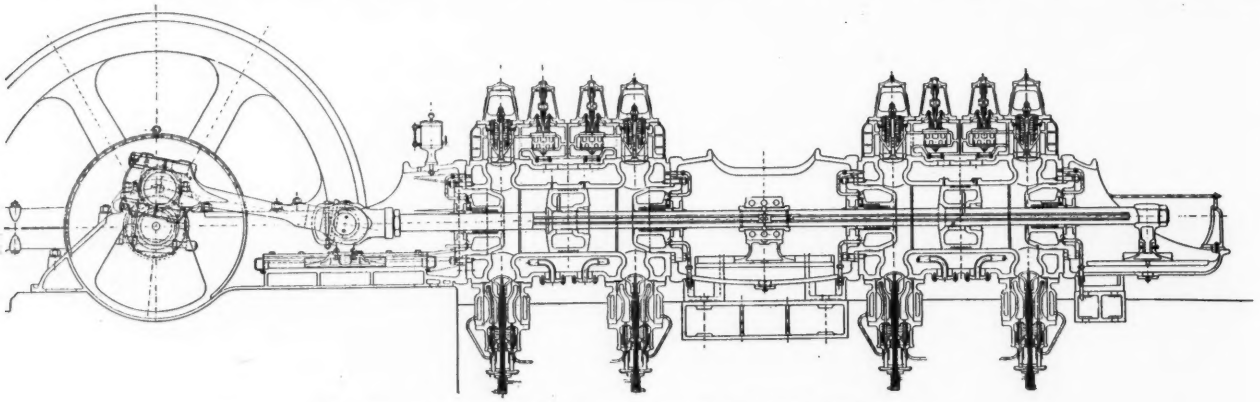


FIG. 2.—700-HORSE-POWER, DOUBLE-ACTING, TANDEM GAS ENGINE.

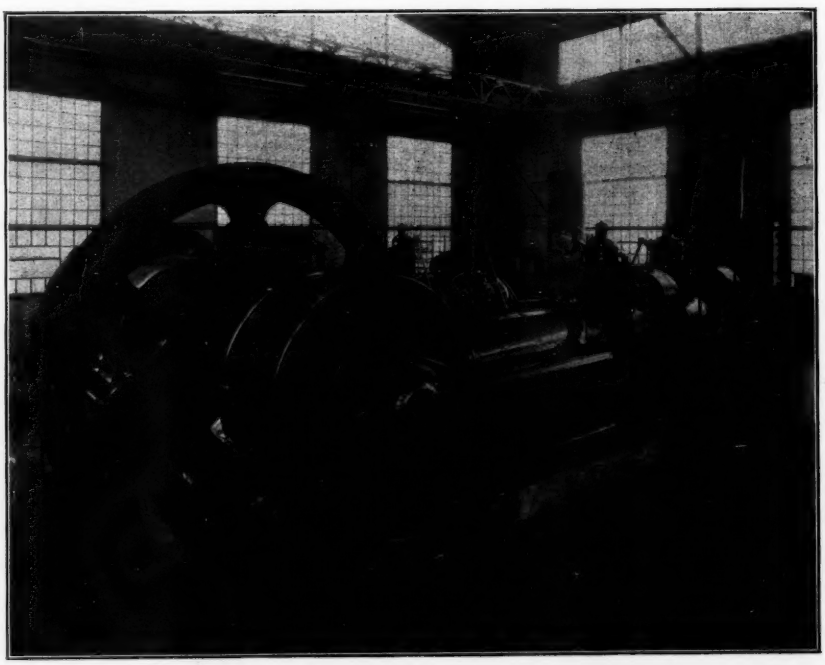


FIG. 3.—650-HORSE-POWER GAS ENGINE, DIRECT-CONNECTED TO CONTINUOUS-CURRENT GENERATOR AT THE HALBERGER IRON WORKS.

the engine can be switched off from blast-furnace gas to coke retort-gas or to gas of any other quality. The exhaust valves are very accessible, as by removing the cylinder covers they can be inspected and cleaned. The gas cylinders are suspended and the spaces underneath them are not encumbered with cylinder feet and pipes, and in consequence there is plenty of room for getting out the exhaust valves if necessary.

A separate electromagnetic ignition apparatus is provided at each end of the cylinder, ensuring reliable ignition, rapid combustion of the mixture, and uninterrupted running. The instant of firing can be adjusted separately for each apparatus or all can be adjusted together according to the load and number of revolutions of the engine.

The lubrication is now regarded as one of the most important points in connection with the gas engine. In this engine the principal working parts, such as the main bearings, etc., are supplied with oil under pressure. This pressure is readily adjusted and consequently the quantity of oil also. A pump actuated by the engine serves as a feed. Arrangements are made for collecting the waste oil, cleaning it, and then returning the same to the feed-pump. All these operations are automatic and require no attention on the part of the attendant. Parts exposed to the pressure of the explosion and high temperature, such as the cylinder, piston, stuffing-boxes, piston-rod and exhaust valve spindles, are provided with separate lubricating pumps.

In addition to the above-mentioned cooling of the piston and piston-rod, all other parts exposed to high temperatures are also provided for in this respect. Generally from thirty to forty feet of head are sufficient for this cooling, only the piston requiring a pressure of about fifty pounds per square inch according to the size and number of revolutions of the engine. When such a head is not available a special pump is fitted for this purpose. As usual compressed air is employed for starting the engine, the supply and adjustment of the air inlet and exhaust being effected by automatic gear. For setting the engine in its starting position and adjusting the valve gear an electrically driven barring gear is installed.

The attendance at the Lewis and Clark Exposition at Portland is remarkably good. From the very first day the average was above 10,000 and on some days there have been 20,000 people present. If this average keeps up throughout the season the exposition can not fail to be a financial success.

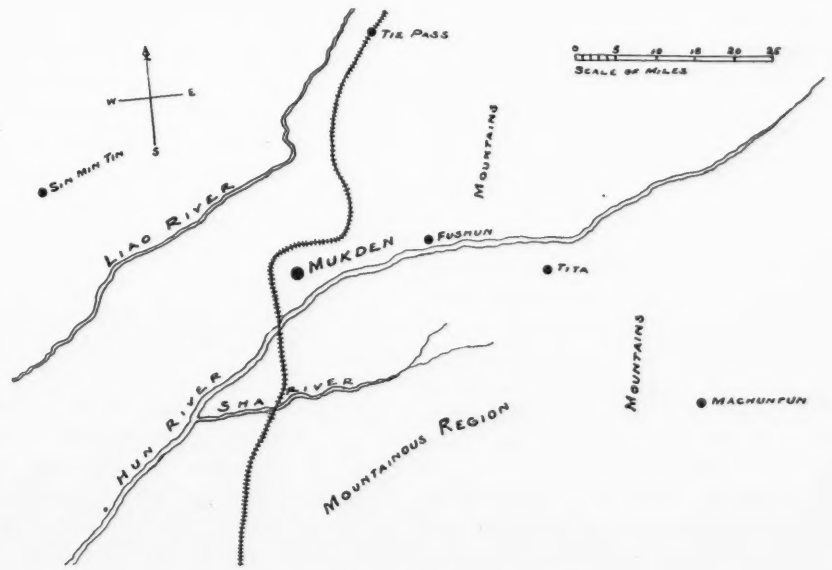
THE USE OF THE TELEPHONE BY THE JAPANESE ARMY AT THE BATTLE OF MUKDEN.

BY M. C. SULLIVAN.

It is a paradox of the Russian-Japanese war, with all its ruthless butchery and slaughter, its heroic assaults and no less gallant defences, its week-long battles and murderous engagements, that one of the principal agencies to the success of the Japanese belongs to the arts of peace.

Modern artillery, modern rifles, all the deadly paraphernalia of destruction and all the mechanical means of death that modern military science can devise have done their worst on both sides.

The courage of the fighting men of both nations is beyond dispute and if the results depended on mere bravery the issue might still hang in the balance. It is through the superior use which the Japs have made of the most ordinary devices of commercial and social life—the telegraph and telephone—that they have hitherto beaten the Russ at every turn.



STRATEGICAL POINTS, BATTLE OF MUKDEN.

One of the most remarkable events that has occurred in the world's history is the battle of Mukden, remarkable because it was the mightiest land battle ever fought and startling because no victory was ever won by such scientific methods. Feats were accomplished by the Japanese never before contemplated in war and which had been previously declared by military experts to be impossible. The success of the victorious forces was almost entirely due to the skilful use of what is to-day considered to be one of the most ordinary and commonplace among electrical instruments—the telephone.

Formerly, a large battle was to a certain extent a haphazard hit-and-miss affair, the careful foresight of the most skilful general failing to take into account the many accidents and incidents which would in almost a moment alter the entire aspect of things and change a successful movement into an utter failure. Not so now, however, as by means of the telephone it is possible for the commanding officer to keep in touch with each individual unit of an enormously large army, and thus to make the best use of all portions of it at all times, thereby obtaining the greatest possible effect with the least expenditure of energy.

There is no better example of the utility of the telephone in military operations than the battle of Mukden. In order to understand clearly the wonderful unity and precision with which the enormous army under the Japanese general acted, and why it was possible for it to so conduct itself, it will be necessary to consider briefly the condition of affairs around Mukden, what each combatant wanted to accomplish, and why on the one hand the Russian failed utterly to grasp the situations quickly enough to save himself from a rout, while on the other, the Japanese commander at all times knew accurately what was taking place and was able to outgeneral his adversary at every point.

As will be seen by reference to the map, Mukden, at which place the Russian general elected to make a stubborn stand, is flanked on the north, east and south

by highlands and ranges of hills, while on the west and northwest the country is flat and open.

The Russians had constructed defences south of Mukden consisting of tier upon tier of redoubted ditches, trenches, gun pits, entanglements, tunnels and every method of protection known to military engineering skill; a barrier which foreign experts pronounced impregnable, but which proved useless against a single turning movement accurately timed. As a matter of fact, miles of these works fell into Japanese hands without firing a shot.

As will be remembered, the approach of the Japanese was from the south. The Russians had become firmly embued with the idea that the training of their adversaries had been such in the mountains of Japan as to render them very inefficient in the open; consequently, Kuropatkin thought that Oyama would move his forces through the mountainous region to the east of Mukden with the intention of breaking through, avoiding as much as possible the open country to the west. The intention of the wily Japanese general, however, was just the reverse, his plan of operations being to divert the attention of the Russians mainly to the south and east, so that it would be possible to develop a flanking movement northerly and easterly around the west side of the city, up through the broad plains between the Hun and Liao rivers. In order to do this, the main Japanese army, which was composed of five grand divisions, was gradually extended so as to form an enormous crescent, the tips of which were more than ninety miles apart. We have therefore to consider this immense battlefield as divided into five sectors. Each division was kept in touch with and under the supervision of the general staff by means of telephonic communication. From the subdivisions of each portion of the army telephone lines were run to a portable switchboard, and from the various switchboards trunk lines were run to headquarters several miles to the rear. Thus the parts of each portion of the army were made to correspond with the subscribers of a telephone substation in a large city, the headquarters being analogous to the central station to which all of the subsidiary stations are connected by trunk lines.

The Japanese general thus had complete control of his entire army and could work his forces to the best advantage at all times and under all circumstances; the movements so directed were at the same time quick and accurate. Moreover, for these reasons, it was possible to use a much thinner line than ever possible previously, and also to reverse the usual order of procedure, namely, to extend and strengthen the flanks of the army at the expense of the centre instead of depending, as heretofore, upon the centre to help out the flanks in cases of emergency. This Oyama did, and while spreading out his army to the east, with the twofold object of attracting the attention of the enemy and encircling him, he was able at all times to strike a blow at any weak spot that developed itself in the Russian line, on account of the fact that he was instantly informed of such weakness by telephone, and because by the same means he could immediately give orders for the necessary attack.

While this movement was in progress the western portion of the crescent was gradually pushed northward in a rather unostentatious and apparently aimless manner, the object being to get it into position to cover the real flanking movement of another portion of the army just behind and to the westward of it at Sinmin Tin. When the time was ripe and the main strength of the Russians had been drawn off to the east and south, which resulted in the fierce battles of Tita, Machuntun, Fushun and the Sha river valley, the western division of the Japanese army began to move toward Mukden; by this manœuvre the Russians' attention was occupied, so that the real flanking movement of the extreme western division which moved eastward from Sinmin Tin was unnoticed until it had got to the north of Kuropatkin, and he was forced to evacuate Mukden and to start upon his most disastrous retreat to Tie Pass.

When it is remembered that these operations involved the handling by Oyama of 400,000 men over a front of a 100 miles or more for nineteen days, every day witnessing a murderous engagement, it will be seen at once that it would have been impossible with the old means of communication, couriers, etc.; but with telephone lines laid and handled by skilful electricians and operators, the problem became easy of solution. Oyama knew at all times the exact state of things at all points, both in respect to climatic conditions and in the disposal and behavior of the enemy's forces and of his own; consequently he was able to act quickly and to direct the movements of each individual unit with the same precision as would have been possible if he were with all the commands at the same instant.

The rapidity with which the Japanese established telephone communication was remarkable. Lines were laid well in advance of the main body of troops, even when the army was advancing by forced marches, and perfect connection was maintained at all times between the different divisions. Wherever conditions permitted, the reels of wire and the instruments were carried in wagons. The line was laid on the ground as rapidly as a horse-drawn vehicle could advance. If the line so laid was to become permanent, a detail followed the wagon at leisure and attached the wire to trees or hastily erected supports.

For "flying lines," or lines within the zone of action, which connected the commander's headquarters with the various divisions on the firing line, the detail following the reel wagon merely laid the wire in protected places on the ground where it was least likely to be disturbed. These lines were taken up, moved, or abandoned, as occasion demanded. Where the nature of the country or other conditions rendered the advance of a wagon impossible or inexpedient, the line was advanced by men carrying coils of wire on their shoulders.

Although military glory has diminished considerably among enlightened people, it has by no means become obsolete, yet it is one of the most hopeful signs of the decadence of the war spirit that the more science is brought into play instead of brute force as a controlling factor on the battlefield, the greater will be the tendency to lessen popular interest in war. As a result, battles will become matters of commonplace scientific routine, for the war spirit of all time past has been born of the hope of glory to be won through personal achievement directly executed, and not through a superior knowledge of scientific methods of indirect killing.

Fixation of Nitrogen.

Some recent work on the fixation of nitrogen has been done by M. E. Rossi, a brief reference to which is given in *Nature* (London), June 1. Rossi has attempted to increase the efficiency of that method of synthesizing nitric acid by means of the electric arc. He uses air under great pressure, and substitutes for the arc an incandescent resistance similar to the filament of the Nernst lamp. The nitric oxide formed is absorbed by concentrated sulphuric acid as fast as it is produced, in order to avoid losses.

GETTING NEW BUSINESS BY ADVERTISING.

A SYMPOSIUM OF IDEAS ON THE VALUE OF WELL-DIRECTED AND ORGANIZED PUBLICITY.

At the recent convention of the National Electric Light Association the subject of advertising received a great deal of attention. Many opinions were expressed, some of which have been grouped and are presented as follows:

JOHN F. GILCHRIST.

I believe that a certain amount of money can be wisely spent for advertising in connection with the business-getting department of every company. I have heard a statement made by some central station managers, generally in small cities I will admit, something like this—our plant is there, the people all know where we are, and they know what we have to sell, and what is the good of advertising? If they want light let them come around and get it.

Even in a small community there is no doubt that advertising, although you can not trace the direct results at all times, will do good. The company which I represent started in possibly five or six years ago to do a little advertising. That has been increased each succeeding year. We are issuing a bulletin with the results of which we are entirely satisfied, and we feel that we are warranted in spending for advertising probably one-third of the entire amount which we spend for getting business. We have conducted during the past year an advertising campaign which was arranged for us by the Bates Advertising Company, of New York, and have watched the results of it very carefully. It prepared for us a lot of material which was very unique and good in many ways. We have kept a closely tabulated record of all the returns which we could trace directly to it, and the amount is very considerable. When we take the total cost of that campaign and figure the direct results obtained, our cost per lamp, sixteen candle-power equivalent, is high; but I have a theory, and I think it is sound, that you are warranted in spending a larger amount for a certain excess of business which will be the direct result of advertising—which otherwise you would not get—than you would be warranted in spending for your entire business. For instance, we will take the case of a station which, by the canvassing methods which we will assume are thoroughly up to date and about as ample as the territory will permit, will bring in an increase of one hundred thousand sixteen-candle-power lamps equivalent per year, and we will suppose it costs to get these lamps from twenty-five to thirty cents per lamp for the costs of your business-getting department. We will assume that the field has been worked to the absolute limit. Now, if the advertising man comes along and shows you where you can get an extra twenty-five thousand lamps in that year, even at an expense of one dollar per lamp, that you can not get in any other way, except by that advertising, I think you will all admit that you are warranted in spending the one dollar per lamp for the extra twenty-five thousand lamps, because in the development of our business time is very much of the essence—it is not to any man's credit or any company's credit to get an amount of business in a period of three years which might have been obtained in a period of one year; and what shows to the credit of the central station man is the amount of business he can get in the shortest time. Some stations will pride themselves on having in a year obtained 50,000 lamps. Why not double their energies and get that 50,000 lamps in six months? Supposing we do spend money, after all it comes out of the other fellow. I am thoroughly in favor of spending a very considerable amount for advertising. The question of how much should be spent, as based on your gross sales, is the problem. I should estimate it to run somewhere from two to two and one-half per cent. That would include the entire costs of getting the business and the advertising; two-thirds on the soliciting force and one-third on advertising.

C. W. LEE.

In regard to new business methods, it came to our attention this spring in a territory we recently had acquired and in which we put into effect our business methods and soliciting that in a month's time we were able to do more business and create more new business than was done during the entire past year by the company that had the plant before we bought it. This was in New Jersey. I believe that the central station man in the small town with a small appropriation can get relatively just as good results as the big companies can with their large appropriations. If you have only $500 to spend, spread it out; do not spend it for one booklet and send that out and then throw up your hands. Get out five or six pieces of matter and issue them two or three weeks apart. Follow up the matter thoroughly. I believe any company can create new business in that way in towns of ten, fifteen or twenty-five thousand, just as well as in cities like New York, Chicago, Boston and Denver. Our plan of campaign is rather large. We are able to buy better designs and pay more money for them, having a large campaign, covering a number of different towns, than you would in a town of 10,000 inhabitants. I should say probably one-half of one per cent would cover such a town very nicely for advertising proper. That is, one-half of one per cent on the gross earnings.

ARTHUR WILLIAMS.

We must not lose sight of the fact that all of our advertising is purely supplemental to personal canvassing. Both should go hand in hand. Newspapers, street cars, bulletins and billboards, follow-up letters, postal cards, all of these things should be at all times so constructed and issued as to follow up most effectively the working of your canvassing department. Advertising is a branch of the canvassing department, and in my opinion one without the other is quite incomplete. I think also that it is very important to carefully classify advertising according to the business and the men who are working in different branches of your business. We have gone so far, perhaps too far, as to issue a series of letters of this separate order to each line of business we could reach. We would not think of sending such a letter to the owner of a laundry that we would send to the owner of a butcher shop. We have gone so far as to solicit Chinese laundries. Chinamen are among the best customers that can be found. We are ourselves surprised oftentimes at the extent to which a very small shopkeeper can pay for electric light; three or four times as much as has been paid for gas will be paid for electric light in one form or another. Light and advertising go hand in hand. Light to-day is advertising.

We are now working in line with some of the other companies, large and small, in the use of a sign very much like an arc lamp, that is to say this panel sign, and in certain sections with splendid results, furnishing the sign free. We do not attempt to control it. We do say what the cost will be and guarantee the cost provided it is used a certain time each day, one hour or two as the case may be. The sign may be taken down as the arc lamp may be taken down, when it is no longer desired and put in the storeroom, awaiting another consumer. That kind of signwork is equal to any electric light work and these signs have the advantage over other kinds, that there is practically no

abnormal depreciation. The life of the sign is not dependent upon the occupant of the premises.

JAMES I. AYER.

The discussion on advertising has brought to my mind a good deal of experience which has come to me in the course of my contact with central stations and reports from station managers where they have undertaken advertising campaigns that were not successful, and in all my recollection of such cases I think the causes of the failure were evident. If the newspaper work brought unsatisfactory results it was due to the fact that in their enthusiasm they jumped in and took a large amount of space. They started in without any definite plan of campaign. They thought they would try the field and see what it meant. Undertaking newspaper advertising in that way is ill-advised and it is not worth while to spend money in printer's ink, particularly in that way, unless you are sure you are going to be able to follow it up. In handling that character of advertising, you should plan out a campaign for a period of not less than a year. Determine the amount of money you are willing to invest that way and arrange to spread it over the period of a year. In your local papers the method of placing the advertising should be seriously considered, and if a small space is occupied you should be careful to see there is fresh reading matter every issue, if possible. It is a difficult thing for a busy station man to personally attend to the matter of advertising and to do it well. The trade papers and bulletins of the large companies are all available to you, and out of the multitude of bulletins you can get sufficient matter, which you can clip to keep your advertisements in the local papers fresh, and it would keep the public mind active and directed to your business with very little effort. It would mean going at it systematically, but that is all. You can lay out a two months' advertising from a half dozen issues of such papers as I have mentioned, apparently using local notices and paragraphs and accomplish the work in a short time. If you are to get results from advertising to-day or to work in the best way it means that you must do it in a short time or you will not do it at all. The average central station manager is too much occupied with the other duties of his position to be able to give the amount of time which is really necessary to the matter of advertising. As has been said, advertising and personal solicitation should go hand in hand; in fact, all methods of advertising should be arranged to assist each other.

One of the gentlemen referred to the point of making your office an advertising room. That is well exemplified in Denver; but on a small scale, relatively, it may be done in every community where there is a lighting plant. It is perfectly practicable and would certainly be worth the rent for you to occupy a store or location that is as good as the location of any merchant in town. If it is not perhaps as important as some of them, it should be central and you can make it very attractive by using the products and materials which suggest themselves for your advertising campaign. Attractive methods of showing up the office by electricity at night make the office very noticeable and is a strong advertising factor. The office should be easy to get into, it should be on the street level, and if only a small office you should display there all those helps to business, the stepping-stones of the business, as it were, such as sewing-machine motors and all that class of apparatus. To a great extent it is perfectly possible for every station man to do these two things, and there is no doubt if you will be conservative and plan out an idea for your newspaper advertising, as suggested, you will find it wonderfully responsive.

There is no doubt in the world if you spend $200 or $300 in three months in a town of 10,000 people in newspaper advertising, or even half of it, you will be disappointed with your results and give it up. That is the usual result. In connection with your office, the goods that are to be displayed should be displayed in such manner as to keep them in salable condition, that is in presentable condition. If you have small samples, portables and that sort of thing, as well as the heating apparatus, they should be kept, if practicable, most of them under glass, because as a rule central station people have not the time to keep them polished up—you show them to your customer hurriedly and out you go. If they are kept in a showcase they will be protected and be presentable. When customers are shown goods and conclude to try something you should deliver the article that you show them; in other words, even if you carry a stock of goods, it is better to give them the sample and take the article out of stock for your showcase. It keeps your samples fresh and your exhibition in good shape. Give the customer the motor he examines; bring out the fresh ones. That keeps the stock fresh.

For central stations where soliciting must be done by the manager or by his assistant, incidental to his other duties, these two methods are the ways to get business and the ways you will find most productive. The detail of handling the showroom can be explained, but I think it is pretty well understood that where you have samples you can afford to put out to almost any of your customers any of your samples on a week or a ten days' trial. I do not think there is any doubt in the minds of most men that that is not only desirable, but the best way to do, the way that will bring quickest and best results. All gas men are united in agreeing with that statement. Such central station men as have consistently carried out that practice have found it very profitable.

National Electrical Contractors' Convention—Electrical Features at the Boston Exposition.

One of the attractions which will be seen at the International Electrical Exposition, to be held in the Mechanics' Building, Boston, Mass., July 15-22, will be a giant magnet lifting tons of dead weight. The touch of a button charges the magnet, allows a mass to be raised, swung into place, or lowered, as the case may be, and instantly released by shutting off the current. Chucks, clutches and grips of a great variety, for a wide range of machine work, will also be shown operating in the same manner. Another interesting feature will be an elaborate X-ray outfit; also a complete exhibit of medical and surgical electrical apparatus.

Among the quarry machinery will be seen a model of a large five-motor electric traveling crane, which has recently displaced ten of the old steam power derricks in a Vermont marble quarry. This crane easily raises a block of marble weighing fifty tons to a height of thirty-five feet, and travels 800 feet. Electric drills, chisels, saws, buffers and channeling machines of the same character are also greatly reducing hand labor.

A new electric annunciator for special use at elevated stations, notifying passengers in advance of the route, destination and stops that the approaching car or train will make after leaving a station, will be exhibited.

A new wireless trolley, doing away with overhead structures as well as the third rail, will be shown in operation.

The National Electrical Contractors are to hold their annual convention during the exposition on July 19. The convention details are being rapidly perfected. Special trains will be made up in Chicago and New York, and will be met by the reception committee on arrival in Boston and escorted to headquarters. On the afternoon of Thursday, July 20, a special boat will take a party of 1,000 members and guests to Paragon Park. There will also be auto trips for guests every day during the week.

Mr. Chester I. Campbell, manager of the exposition, reports that space is being taken rapidly, and that this exhibit will be the most elaborate and successful that has yet been held.

SMOKE AND ITS ABATEMENT.[1]

BY CHAS. H. BENJAMIN.

The smoke nuisance has long been one of the bugbears of living in the Middle West and is now rapidly becoming an important factor in the East. It is so much easier to keep this nuisance out than to get rid of it when once in, that the residents of cities on the Atlantic seaboard ought to be alive to the situation.

The fact might as well be recognized at once that the supply of so-called smokeless fuels, anthracite coal, petroleum, natural gas, etc., is limited and will not begin to satisfy the demand. The supply of bituminous coal on the other hand is practically unlimited, and it is doubtless the fuel of the future. The abundance of it, its cheapness and the readiness with which it burns, even with a poor draft, combine to make it a most desirable fuel.

The problem for our engineers and lawmakers is not how to prevent the burning of soft coal, but how to burn it in such a way that the combustion shall not be a public nuisance.

Unfortunately this, our best fuel, is at the same time our dirtiest fuel both in the handling and in the burning. The smoke from most other fuels, while not suitable for the lungs of human beings, is, if carried to a sufficient height by a chimney, comparatively inoffensive, since it does not return to earth. It is not practicable to prevent the evil entirely, but only to mitigate it in a degree.

It will be well at the outset to state three propositions: *a*. The smoke from bituminous coal is a nuisance, especially in large cities. *b*. Such smoke can in the majority of cases be easily abated. *c*. Such abatement can be made a source of profit to the owner of the plant as well as to the community.

Objectionable black smoke is due to the presence of hydrocarbons in the fuel and is produced as follows: the hydrogen and carbon compounds in the coal are driven off as gas by the heat at a comparatively low temperature, and may escape unburned. In this condition they would not constitute smoke in the common sense of the term. If heated to a sufficiently high temperature in the presence of air they burn with a yellow flame. If the air supply is insufficient, is poorly mixed with gas, or if the temperature is lowered in any way, combustion is checked and carbon is deposited in the form of soot or carried off with the gas as smoke.

I can not illustrate this better than by quoting from a paper read last year before the American Association for the Advancement of Science.[1]

The combustion of hydrocarbons seems to be always complete at first. If one watches the slow burning of a lump of cannel in the open grate he will see a whitish or yellowish vapor expelled from the coal by the gradual heat of the fire. This is the carbon and hydrogen combined which is distilled by the heat and leaves behind the free carbon as coke. While the escape of this vapor unburned represents a distinct loss of heat, the vapor is not smoke as we understand it. It does not deposit soot and will not stain or disfigure surfaces in its path.

As the heat increases and air is supplied, the vapor ignites and burns with a yellow flame showing the presence of solid particles. If the temperature remains high and the air supply continues, the combustion is complete and the colorless carbon dioxide and water vapor pass up the chimney. If, however, the burning gas becomes chilled by contact with the relatively cool bricks of the chimney back or if insufficient air is supplied, the yellow flame becomes red and dingy, while particles of finely divided carbon are deposited on the adjacent surfaces or whirled away up the chimney.

The ordinary coal-oil lamp is one of the best illustrations of perfect combustion and consequent smoke prevention. The heated gases rising in the chimney produce a draft and fresh air is continually drawn in at the bottom through the hot gauze which warms and divides it so as to ensure thorough mixing with the gases from the burning oil. Turn up the wick and the flame becomes smoky—too much hydrocarbon for the air supply. Raise the chimney slightly from the bottom and again there is smoke—too much air at too low a temperature which chills the flame. Insert a cool metal rod into the chimney and soot is deposited on it—chilling of the flame again and disengagement of the carbon, while the hydrogen continues to burn.

And thus we may learn of the three requisites for good combustion; enough air, a sustained high temperature and a thorough mixing of the gases. The last two are so important that it is entirely possible to have an excessive supply of air and dense black smoke at the same time.

It is difficult to form any estimate of the amount of damage inflicted by soft coal smoke in a city like Pittsburg or Cleveland, but it probably amounts to hundreds of thousands of dollars annually.

The deterioration of dry goods, draperies and delicate fabrics on the shelves and counters and in the show windows is a direct tax on the buyer. In the book trade the situation is perhaps worse.

The presence of more or less sulphur in the soot renders it a corrosive as well as a discoloring agent and greatly increases the damage done. Trees and shrubs suffer in such an atmosphere and are frequently killed outright by the presence of sulphurous smoke. The effect on human beings has not been definitely determined, but the deposition of soot on the delicate tissues of the respiratory organs can hardly be beneficial.

In law a nuisance is "such a use of property or such a course of conduct as, irrespective of actual trespass against others or of malicious or actual criminal intent, transgresses the just restrictions upon use or conduct which the proximity of other persons or property in civilized communities imposes upon what would otherwise be rightful freedom." (Century Dictionary.)

Smoke is then a nuisance and can be prohibited by state or municipal enactment as the case may be. I have no more right to deluge my neighbor's premises with soot than I have to empty my garbage can over the fence line. The abatement of smoke is in principle extremely simple, but presents some difficulties in the practical application.

Only three conditions are necessary for complete combustion, the proper temperature, the proper air supply, a thorough mixing of the air and the hydrocarbons. The last condition is as important as any and is one too often neglected. It is this condition which gives the gas or liquid hydrocarbon an advantage over the solid, since the atomizing of the former by the steam or air jet ensures the most intimate contact between the air and the fuel.

The use of pulverized coal in combination with air or steam is a close approximation to the above, and, when properly managed, gives good combustion, no smoke and a high efficiency. The cost of pulverizing and the impracticability of storing pulverized fuel have so far hindered the more general adoption of this process, except for metallurgical work.

When coal in the ordinary form is used as a fuel, smoke abatement involves some means of varying the coal supply and the air supply according to the demands made upon the boiler. When ordinary handfiring is resorted to, the great irregularity of the coal supply will cause poor combustion and smoke unless the air supply is varied to correspond. Steam jets are frequently employed under these circumstances, and, if properly put in, will improve the combustion by drawing in additional air over the grate and mixing it with the products of combustion in front of the bridge wall. The steam jet should

[1] Abstract of a paper presented at the Scranton meeting, June, 1905, of the American Society of Mechanical Engineers.

[1] *Science*, March 25, 1904.

be semi-automatic, the steam and air being turned on by the opening of the fire door and gradually closed off by a dash-pot attachment.

The best solution of the smoke problem, so far, has come from the introduction of mechanical means of handling the coal, which give a uniform feed to the fuel and a corresponding delivery of air combustion. The use of mechanical stokers has been brought about by the natural demand for machine handling in large power plants as more economical than human labor, rather than by a philanthropic desire to benefit the community. It has been estimated that one able-bodied man with a shovel and slice-bar can take care of 200 horse-power of boilers. With good mechanical stokers he can handle double, and with complete coal and ash-handling equipment three times this amount.

Stokers may be divided into three principal classes: inclined shaking grates—traveling or chain grates—and underfeed stokers.

The inclined grate, as exemplified in the Wilkinson, Brightman and Roney stokers, has a hopper in front and slopes down and back, having a clinker grate just in front of the bridge wall, while the double incline, as in the Murphy and Detroit stokers, has a magazine on either side and slopes in two planes parallel to the axis of the boiler, meeting in a clinker grate at the bottom. The principle of action is practically the same and involves the slow coking of the coal on a dead-plate, the pushing forward on to the top of the incline and the gradual descent, impelled by oscillation of the grate bars, until the combustion has left nothing but ash and clinker at the bottom. Air is usually admitted both below and above the grate, and the hydrocarbons which are distilled at the top of the grates pass through the intense heat of the burning coke on their way to the bridge wall and are completely burned. The double incline usually has a revolving clinker bar which disposes of some of the ash automatically, but as a rule both forms need considerable cleaning. When used with a fuel which does not cake or clinker too much and when not crowded too hard these stokers are economical and reduce the smoke considerably.

If, however, it becomes necessary to slice and poke the fire on account of caking coal or overcrowded boilers, unburned masses of coal are rolled to the bottom and holes are made in the fire through which cold air rushes. Both of these circumstances make for poor combustion and a smoky fire. As a rule firemen poke the fire on stokers too much, doing more harm than good.

Cleaning is usually a source of black smoke for a few minutes, but this is mostly unnecessary if the fireman understands his business and gets his fire ready for cleaning beforehand.

The traveling or chain grate is rapidly coming into favor as a means of stoking automatically. It consists, as in the Babcock & Wilcox and Green stokers, of an endless horizontal chain running on sprocket wheels and carrying the coal back under the boiler, finally dumping the refuse over the back and into the ash-pit. The distilling process and the gradual burning of the coke are much the same as in the stokers just described. In order to prevent waste through the grates the latter are usually quite close, and it becomes necessary to use more draft than with ordinary grates.

A damper is used underneath the grate to prevent an excess of air from passing up behind the grate. Some tests recently made by a large corporation which uses a considerable number of chain grates showed an evaporation of only 5.7 pounds of water per pound of coal. An examination disclosed the fact that a large excess of air was passing through the comparatively bare grate at the rear end. The introduction of a damper to regulate this brought about a great improvement. With the same fuel and same conditions as before an evaporation of eight pounds of water per pound of coal was obtained.

From observations covering a period of several years I have come to the conclusion that this type of grate is the best one yet devised for abating smoke. The fact that it is horizontal, so that unburned coal can not run to the rear end, and the further fact that it is self-cleaning and need not be disturbed by the slice-bar, make it an almost ideal furnace in this respect. If run by an intelligent fireman who understands adapting the depth and travel of the fire to the work to be done, it will also be a very economical furnace.

The underfeed stokers operate on an entirely different principle, the coal being fed in underneath the grate and forced up through a rectangular opening in the centre. A forced blast is used and the air for combustion is blown up through the coal, the tuyères being on either side of the rectangular opening just mentioned. By this arrangement the fresh coal is always underneath and the distilled gases are obliged to pass through an incandescent mass of fuel in company with the air. With a proper pressure of blast perfect combustion is thus almost unavoidable. The ash and clinker are now at the top of the fuel, which forms a gradually rising mound in the centre and pushes the clinker over to either side, whence it is removed by hooks through doors at the front. The heat generated is such that the ash generally melts and forms a sheet of clinker which can be easily removed without disturbing the fire. My experience has shown the underfeed stoker to be economical in operation and practically smokeless.

A criticism frequently made in regard to mechanical stokers is that they will not respond quickly to sudden changes in the load, that it is difficult to keep a uniform steam pressure under such circumstances, and that for this reason they are not economical. There is some truth in this. It is easy to conceive of circumstances, especially in electric plants, under which it would be difficult to maintain a uniform steam pressure with either the oscillating or the traveling grate. For regular fluctuation of load, as in electric lighting or railway power-houses, the obvious remedy is the introduction of storage batteries and the provision for ample boiler reserve.

Minor fluctuations can be taken care of by the fireman unless they become too numerous or too violent. In the latter case the underfeed stoker with the plunger feed comes the nearest to satisfying the demand. With the power of instantly regulating the motion of the plunger and the pressure of the blast, it is thus possible to meet emergencies of this kind more promptly than by hand-firing.

The economy resulting from the abatement of smoke is naturally a potent argument in its favor. This phase of the subject has, however, but little to do with the ethics of the question. Once prove that it is practicable to abate smoke and the community has a right to insist on its abatement regardless of economical considerations.

Fortunately this difficulty does not exist in most cases, for it may be stated as a general proposition that smoke abatement means economy in fuel consumption. The proof of this statement is extremely simple: fuel economy results from good combustion, good combustion is accompanied by little visible smoke.

The problem to be studied by the manufacturer should be how to obtain the most perfect combustion of the particular fuel which he uses and then the smoke question will take care of itself. Let him make frequent analyses of chimney gases, compare different press-

ures of draft and different dispositions of dampers and he will be repaid for his trouble in more ways than one.

With the introduction of mechanical handling there is a reduction in the quantity of manual labor and there should be an improvement in its quality. Manufacturers should understand that if they expect to get the benefit of improved machinery they must have men competent to run it to the best advantage.

A conservative claim of from ten to twenty per cent saving, depending upon how smoky the furnace has been, can usually be substantiated by a comparison of the coal bills before and after introducing stokers, without restoring to expert tests. I have known so simple a thing as an automatic steam and air jet to pay from 50 to 100 per cent annually on the original investment, as determined by the coal bills.

If I have said little in this paper about means for smoke abatement other than stokers, it is because I believe that the stoker is the best remedy where it can be used, and that it should always be adopted in new power plants.

Whenever for any sufficient reason the stoker can not be introduced, there are other devices which will mitigate the smoke nuisance considerably and also save fuel. The steam and air blast has already been mentioned. A recent improvement which promises well is the combination of steam jets at the bridge wall with oil vapor, creating an intense heat at that point and consuming the hydrocarbons as they pass through. The expenditure of oil is comparatively small and considerable economy is said to result.

Brick arches and baffle walls have also assisted in maintaining a high temperature and in properly mixing the gases. The use of a reverberatory furnace or outside oven in which the coal and its gases are thoroughly burned before going to the boiler is another satisfactory method of reducing smoke, and may be used as well with as without a stoker.

In short, whatever produces good combustion abates smoke. In apartment houses and stores where the boilers are used for heating only and the steam pressure is low, the use of fuels which are comparatively smokeless is about the only satisfactory solution.

I believe that the municipalities have a right to insist upon the abatement of black smoke by all users of steam boilers, without regard to the purposes for which the steam is used or the means to be adopted for abatement. This, because smoke is a public nuisance and because it can be abated without hardship to the owner of the plant. Nevertheless, when the evil is present and has been present for a period of years, it is not good policy to be too radical in the enforcement of the statutes. The law should be definite and stringent and the penalties adequate, but they should be enforced with discretion by officials who have some technical and practical knowledge of smoke abatement.

It is absurd to talk of putting this matter into the hands of the police or of the health officer. The official having charge of this work should be a trained engineer, if possible a technically educated man, and he should be entirely above graft in any of its disguises.

To summarize the facts and principles of smoke abatement, I would repeat:

(1) Black smoke is a public nuisance and should be regulated by legal means.

(2) It is a result of imperfect combustion and can be largely abated by proper methods of stoking.

(3) Mechanical stokers offer the best means of accomplishing this result, in medium-sized or large plants.

(4) As smoke abatement is a result of better combustion economy of fuel is the natural and obvious result.

To these I would like to add one more, a principle which is common to all reforms:

(5) An educated and intelligent public sentiment must be the moving and compelling force, without which mechanical devices and legal enactments will both fail.

When the public comes to realize its rights in this matter and that it is under no more obligation to submit to this nuisance than it is to endure bad drainage or filthy streets, laws will be enacted and enforced and the people will wonder that they so long submitted to this unreasonable imposition.

Convention of the Master Car Builders' Association.

The annual convention of the Master Car Builders' Association was held at the Oriental Hotel, Manhattan Beach, L. I., from June 19 to June 21, inclusive. Sessions were held in the ballroom of the hotel, and the following reports and papers were presented:

Report on "Revision of Standards and Recommended Practice," "Triple Valve Tests," "Brake Shoe Tests." Topical discussions on "The Best Method of Preventing or Minimizing the Damage to Metal Parts of the Right of Way from Salt-Water Drippings," and on "Riveting Yokes." Report on "Air-Brake Hose." Report on "Tests of Master Car Builders' Couplers." Report on "Revision of Rules for Loading Long Materials." "Rules of Interchange," including reports of arbitration committee and passenger-car rules, were also discussed, together with reports on "Arch Bars," "Safety Appliances," "Tank Cars," and "Steam Connections." Topical discussions were held on "The Establishment of a Standard Height from Top of Rail to Centre of Drawbar for Passenger Equipment Cars," and "Is It Advisable to Use Malleable Iron for Wearing Surfaces." These discussions were followed by reports on "Repairs to Steel Cars," and "Stenciling Cars."

At the final session on Wednesday, June 21, reports on "Coupling Chains," "Draft Gear," "Guarantee for Cast-Iron Wheels," "Doors" and "Subjects" were presented, followed by the transaction of unfinished business and the election of officers.

The nominating committee presented the following names: president, Joseph Buker; first vice-president, W. E. Fowler; second vice-president, G. N. Dow; third vice-president, R. B. McKenna; treasurer, John Kirby. Executive committee: H. M. Carson, G. W. Wildin, T. H. Curtis. All these gentlemen were elected, and the meeting then adjourned.

Illinois Electrical Contractors' Convention.

The third annual convention of the Illinois Electrical Contractors' Association was held at the Hotel Fey, Peoria, Ill., on Saturday June 10. The principal feature of the convention was the instruction of the delegates to the national convention to be held in Boston on July 19. Officers were also elected as follows:

President, W. A. Robb, Rock Island.

Vice-president, C. E. Stapp, Peoria.

Secretary, C. R. Kreider, Chicago.

Treasurer, E. E. Gibson, Decatur.

Directors, Ernest Freeman, Chicago; Guy Carleton, Bloomington; and J. T. Marron, Rock Island.

Director for national association, Arthur Frantzen, Chicago.

The convention was closed with a banquet, at which forty covers were laid, in the Hotel Fey.

SIXTH ANNUAL MEETING OF THE NATIONAL ELECTRICAL TRADES ASSOCIATION.

MONTREAL, CANADA, JUNE 23. NEXT MEETING TO BE HELD IN NEW YORK CITY.

The sixth annual meeting of the National Electrical Trades Association was held on June 23 at La Corona Hotel, Montreal, Canada, representatives being present from all the affiliated local associations in the United States and Canada. The delegates in attendance and the local societies represented were:

G. M. Stuart, of the Stuart-Howland Company, Boston, Mass., representing the New England Electrical Trades Association.

John H. Dale, president of the Dale Company, New York city, representing the Electrical Trades Society of New York.

Charles W. Wilkins, of Partrick, Carter & Wilkins, Philadelphia, representing the Electrical Trades Association of Philadelphia.

James Wolff, Chicago manager of the New York Insulated Wire Company, representing the Electrical Trades Association of Chicago.

C. M. Wood, representing the Electrical Trades Association of the Pacific Coast.

John Forman, Montreal, Canada, representing the Electrical Trades Association of Canada.

There were also present General Secretary Frederick P. Vose, of Chicago, Local Secretaries J. A. Mann, of Montreal, and Franz Neilson, of New York, all three of whom are counselors-at-law.

At the business session lasting the whole afternoon questions of considerable importance came up and careful consideration was given them—particularly to the adoption of new operative resolutions and the modification of others. The retiring president and vice-president, Messrs. John Forman and James Wolff, were succeeded by Mr. Wolff as president and John Dale as vice-president. General Secretary Vose was reelected for the ensuing year. New York city was chosen as the place for next year's meeting.

In the evening the delegates were banqueted by the Canadian association, John Forman acting as toastmaster. Besides those already mentioned, the following named gentlemen were at the board and joined in the merry feast offered to body and mind:

E. F. Sise, the Wire and Cable Company, Montreal.

R. E. T. Pringle, president of the R. E. T. Pringle Company, Limited, Montreal.

Geo. Moffatt, the Robert Mitchell Company, Limited, Montreal.

Geo. H. Olney, the E. T. Phillips Electrical Works, Limited, Montreal.

J. A. Burns, Munderloh & Company, Montreal.

Geo. H. Rough, the Packard Electric Company, Limited, St. Catherine, Ontario.

Geo. Leroux, the R. E. T. Pringle Company, Limited, Montreal.

Alfred Collyer, the Bullock Electric Manufacturing Company, Montreal.

Philip H. Hover, the New York Insulated Wire Company, New York.

H. P. Kimball, the Standard Underground Cable Company, New York.

Speeches were made and toasts were offered by Messrs. Forman, Wolff, Wilkins, Dale, Wood, Vose, Mann and Neilson. Others entertained by story, song and instrumental music.

As generally known, the National Electrical Association is composed of over three hundred representative houses in the electrical and allied trades in the United States, Canada and Mexico. It is a sort of credit information bureau designed to keep the members informed of weakness in the credit of customers in these trades, and it effects its aims in a surprisingly simple and certain manner. Incidentally the members are enabled to secure the collection of accounts which frequently are uncollectible without the assistance of attorneys. The association can not begin to estimate in dollars and cents the benefit accruing from the credit information disseminated to the members, but it can and does estimate the value obtained through the incidental work of collections. For example, it is computed that the New York society alone during its ninth year collected for its members approximately $256,000—an average of over $3,000 for each member. For this service no additional charge whatever is made—the entire cost to the member being covered by the annual dues, which in the New York society are but forty dollars.

All representative electrical houses are eligible to membership, as well as houses in the allied trades which sell to the same customers.

The Rapid Transit Commission has decided to begin experimenting at once to determine the best method of improving atmospheric conditions in the subway in New York city. It has been determined to equip one station with a forced draft apparatus, and another with a refrigerating plant, and see which produces the best result.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

CONVENTION AND EXHIBITION.

The executive committee of the Massachusetts Association of Electrical Contractors held an important meeting, June 22, at which time reports were made showing that all details of the fifth annual convention of the National Association of Electrical Contractors have been perfected. The exposition will open in Mechanics' Building, Saturday evening, July 15, with a fine musical programme by Reeves's American Band, which will also give concerts throughout the week. A large and efficient reception committee will be at headquarters Saturday, Sunday and Monday and will meet the specials due from New York and the West Tuesday afternoon and evening.

The open session of the convention on Wednesday will be a notable event. Addresses of welcome will be delivered by F. L. Barnes, president of the Massachusetts state association; by Governor Douglas in behalf of the state, and Mayor Collin in behalf of the city. E. McCleary, of Detroit, Mich., president of the National Association, will then deliver the annual address after which will come addresses and topics as follows: "The Electrical Contractors' Association," by Charles L. Eidlitz, of New York, ex-president of the National Contractors' Association and ex-president of the Building Trades' Association, of New York; "The Jobbers," by A. L. Gorman, of New York, general manager of the Manhattan Electric Supply Company; "The Manufacturers," (speaker to be announced); "The Underwriters," by F. E. Cabot, of Boston; "The Relations of Inspector and Contractor," by P. J. Kennedy, of Boston, commissioner of wires. There will also be other prepared addresses and general discussion.

An executive session of the National Association will be held on Wednesday afternoon, and the annual dinner to the members of the National Association will be given in the evening.

Thursday afternoon will be devoted to a session of the association and at 2.30 P. M. delegates and guests will embark at Rowe's wharf for an extended steamer trip down the bay, dining at the Rockland House, Nantasket, and visiting Paragon Park in the evening.

Friday will be devoted to executive sessions of the National Association and Saturday will be given up to sight-seeing and entertainment.

A ladies' committee of thirty has been

appointed to have charge of the entertainment of the lady guests of the association. Concord, Lexington, Bunker Hill, Harvard and other historic and interesting places will be visited and an extended auto trip will be taken along the picturesque North Shore. Side trips for sight-seeing and shopping will be made daily. Delegates have already been reported from thirty-nine states.

SOME OF THE EXHIBITORS.

Following is a partial list of those exhibitors who have secured space:

American Electric Novelty Manufacturing Company, New York.
American Circular Loom Company, Chelsea, Mass.
American Electric & Controller Company, New York.
American Electric Sign Company, Boston, Mass.
Automatic Electric Train and Station Annunciator Company, Lexington, Mass.
Appleton Electric Company, Bridgeport, Ct.
Booth & Company, Boston, Mass.
Bryant Electric Company, Bridgeport, Ct.
Benjamin Electric Company, New York.
Bova, L. E., Boston, Mass.
Couch, S. H., Company, Boston, Mass.
Couch & Seeley Company, Boston, Mass.
Cotton, Chas. A., Boston, Mass.
Chase-Shawmut Company, Boston, Mass.
Condit, S. B., Jr., Electrical Company, Boston, Mass.
Dale Company, New York.
De Veau Telephone Company, New York.
Dossert & Company, New York.
Delaware Hard Fibre Company, Wilmington, Del.
Dorn, Philip, Boston, Mass.
Electric Gas Lighting Company, Boston, Mass.
Economical Electric Lamp Company, New York.
Eastern Carbon Works, Jersey City, N. J.
Electro-Dynamic Company, Bayonne, N. J.
ELECTRICAL REVIEW, New York.
Edison Electric Illuminating Company, Boston, Mass.
Eastern Electric Cable and Wire Company, Boston, Mass.
Elm City Engineering Company, New Haven, Ct.
Erickson Electric Equipment Company, Boston, Mass.
Forg, Peter, Somerville, Mass.
Felkin, A. C. & M. L., Boston, Mass.
General Electric Company, Boston, Mass.
Gleason, John L., Jamaica Plain, Mass.
Gould Storage Battery Company, Boston, Mass.
Greenwood & Daggett Company, Boston, Mass.
Homes Manufacturing Company, New York.
Harvey Hubbell, Bridgeport, Ct.
Hill, W. W., Electric Company, New Bedford, Mass.
Johnson & Morton, Utica, N. Y.
Johns, H. W., Manville Company, New York.
Knowles, C. S., Boston, Mass.
McKenney & Waterbury Company, Boston, Mass.
Mullen, Colman J., Brooklyn, N. Y.
Manhattan Electrical Supply Company, New York.
Minimax Company, Boston, Mass.
Marshall Electric Manufacturing Company, Boston, Mass.
Miller Anchor Company, Norwalk, Ohio.
National Carbon Company, Cleveland, Ohio.
Ovington Manufacturing Company, Boston, Mass.
Pass & Seymour, New York.
Pettingill Andrews Company, Boston, Mass.
Proctor-Raymond Manufacturing Company, Detroit, Mich.
Poole, J. W., Columbia street, Boston, Mass.
Renim Specialty Company, Boston, Mass.
Ridgway Dynamo and Engine Company, Boston, Mass.
Roebling's, John A., Sons Co., New York.
Steel City Electric Company, Pittsburg, Pa.
Safety Armorite Company, New York.
Smith Premier Typewriter Company, Boston, Mass.
Sprague Electric Company, New York.
Swazey & Smith, Boston, Mass.
Stuart-Howland Company, Boston, Mass.
Simplex Electric Company, Boston, Mass.
Starbuck-Sprague, Boston, Mass.
Trumbull Electric Manufacturing Company, Plainville, Ct.
Valentine Electric Sign Company, Atlantic City, N. J.
Westinghouse Electric Manufacturing Company, Boston, Mass.
White, O. C., Worcester, Mass.
Wireless Railway Company, Philadelphia, Pa.

THE FOURTH ANNUAL MEETING OF THE NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION.

ALBANY, N. Y., JUNE 16.

The fourth annual meeting of the New York State Independent Telephone Association was held in the city council chamber, Albany, N. Y., June 16. Seventy-eight delegates were present, representing the properties of independent telephone companies throughout the state, having an investment value of more than $150,000,000. The following programme was carried out:

10 A. M.—Address of welcome, corporation counsel, the Hon. Arthur L. Andrews. Response by T. Harvey Ferris, of Utica. Appointment of committees by the president, the Hon. Howard Hendrickson, Albany, N. Y. Report of secretary, T. S. Lane, Buffalo, N. Y. Inspection of exchange of Albany Home Telephone Company by visiting delegates.

1 to 2 P. M.—Inspection of manufacturers' exhibits.

2 P. M.—Report of auditing committee. Report of nominating committee. Election of officers and executive committee. Paper on "Toll-Line Development," T. M. Brush, secretary Independent Union Telephone Company. "Consolidation," George R. Fuller, treasurer Rochester Telephone Company. "Development in the East," W. L. Burke, Troy, N. Y. "Development in Southern New York," George B. Wright, Binghamton, N. Y. "New Methods of Construction," R. M. Eaton, Niagara Falls, N. Y.

5 P. M.—Delegates met at the wharf of the Albany & Troy Steamboat Company, at the foot of Maiden lane, for a river trip on the General Carr.

A clambake was served at "The Abbey" at 7 P. M.

In addition to the regular programme, other important matters were acted upon by the association, and a set of resolutions covering the use of independent telephones in state departments was unanimously adopted. It was the opinion of the meeting that it was the duty of the various state departments to afford telephonic communication to all classes of users of telephones, and not to confine their patronage to any one system. It was resolved that the various departments of the state of New York which have not installed telephones connected with independent companies be requested to install the telephones in the various localities where situated.

The following delegates were selected to attend the annual meeting of the National-Interstate Independent Telephone Association, which was held in Chicago, June 20 and 21: B. G. Hubbell, Buffalo, N. Y.; S. B. Rawson, Albany, N. Y.; T. Harvey Ferris, Utica, N. Y.

A special tariff report covering a uniform method of handling and accounting toll business throughout the state, submitted some time since by the special tariff committee, consisting of S. B. Rawson, T. S. Lane and Edward Davis, was unanimously adopted, thereby providing a uniform method of conducting the toll business of the independent telephone companies throughout the state.

The association is in a flourishing condition. It has a membership of more than 200, and this is rapidly increasing. It is expected that it will accomplish some very good results during the ensuing year.

The following officers were elected: president, Howard Hendrickson, Albany, N. Y.; first vice-president, Boyd McDowell, Elmira, N. Y.; second vice-president, W. R. Campbell, Niagara Falls, N. Y.; treasurer, T. Harvey Ferris, Utica, N. Y.; secretary, T. S. Lane, Buffalo, N. Y.

The following executive committee was elected for the ensuing year: W. L. Burke, Troy, N. Y.; George R. Fuller, Rochester, N. Y.; B. G. Hubbell, Buffalo, N. Y.; Edward Davis, Binghamton, N. Y.; S. B. Rawson, Albany, N. Y.; W. B. Charles, Amsterdam, N. Y.; C. H. Poole, Utica, N. Y.; C. W. Pratt, Boonville, N. Y.; F. M. Potter, Jr., Syracuse, N. Y.; J. F. Stockwell, Oswego, N. Y.; I. H. Griswold, Plattsburg, N. Y.

Canadian Electrical Association.

Fifteenth Annual Convention, Held at Montreal—Large Attendance and a Highly Interesting Meeting. Next Meeting at Niagara Falls.

THE fifteenth annual convention of the Canadian Electrical Association was held in Montreal, June 21, 22 and 23. The headquarters of the association were at the Windsor Hotel, and the meetings were held at the rooms of the Canadian Society of Civil Engineers. The registration bureau at the Windsor Hotel recorded an attendance of delegates and visitors of 326 persons, and the meetings were well attended and papers of an up-to-date nature were read and discussed.

The programme, as announced below, was carried out in detail, and on time.

WEDNESDAY, JUNE 21.

10 A. M.—Meeting of executive committee.

10.30 A. M.—Opening session. Reports. Paper: "Effects of Frequency and Voltage on Transformers," by M. A. Sammett.

2 P. M.—Papers: "Transformers," by R. T. McKeen. "Selection and Maintenance of Service Meters," by Wm. Bradshaw. "Incandescent Lamps," by A. B. Lambe. Question Box.

THURSDAY, JUNE 22.

10 A. M.—Papers: "The Operation of Alternators in Parallel," by A. L. Mudge. "Induction Motors," by H. A. Burson. "Heating of Enclosed Conductors," by Professor R. B. Owens.

12.45 P. M.—Special visit and luncheon at the works of Allis-Chalmers-Bullock, Limited, Rockfield. Special cars leave the Windsor at 12.45 P. M.

8 P. M.—In the evening at 8 P. M. sharp special cars provided by the Montreal Street Railway Company will leave the Windsor Hotel for Electric Park, Back River, where a smoking concert will be held.

FRIDAY, JUNE 23.

10 A. M. Papers: "Economy of Isolated Plants," by K. L. Aitken. "Notes on Steam Engines and Boilers," by Wm. McKay. Question Box.

2 P. M.—Election of officers. Unfinished business.

The local committee in charge of the meeting consisted of the following named gentlemen, all of whom were untiring in their efforts to make the occasion the pronounced success it was: H. D. Bayne, chairman; R. S. Kelsch, F. Wilson Fairman, R. E. T. Pringle, C. F. Sise, Jr., E. F. Sise, Professor R. B. Owens, H. J. Fuller, Wallace C. Johnson, W. F. Dean, Alfred Collyer.

The burden of the occasion naturally fell upon Mr. H. D. Bayne, chairman, and he proved himself to be conspicuously the right man in the right place, in fact, every man on the committee seemed especially fitted for the pleasant duties required of him.

The visit to the works of the Allis-Chalmers-Bullock Company was made Wednesday afternoon, and luncheon to over 200 visitors was served, and the plant thrown open to inspection afterward. At the conclusion of the luncheon Mr. K. B. Thornton, the president of the association, expressed the thanks of the visitors to the company. Mr. George Bullock and Mr. H. H. Henshaw replied and welcomed the delegates to the works of the company. The entire party was shown through the establishment which now has a staff of employés of about 350. Included in the work now under construction in the electrical department is one of two 750-horse-power induction motor-generator sets for the Montreal Street Railway; two 600-kilowatt alternating-current water-wheel type generators for the Southern Light and Power Company, Toronto; and two of four seventy-five-kilowatt direct-current engine type generators for the Canadian Pacific Railroad hotel at Winnipeg. The visitors were also shown the operation of air-compressors, rock drills and coal cutters in the mechanical department.

Subsequently, the same day the delegates paid a visit to the various electrical substations in Montreal. The one in which they seemed to be most interested was that of the Shawinigan Water and Power Company at Maisonneuve.

On Wednesday evening special cars were provided and took the party to Back River at Peloquin's Park, where a temporary open theatre had been erected, with a very artistic stage adorned with cedar boughs. A musical entertainment was provided and supper served.

One of the special cars provided was of a new design intended for observation. It is a large open car with inclined seats, and carries fifty-two passengers. It was handsomely decorated and finished, and is something new in the trolley car field.

The election of officers was held Friday afternoon and resulted as follows:

A. A. Wright, M. P., Renfrew, Ont., president; R. G. Black, superintendent Toronto Electric Light Company, first vice-president; John Murphy, Ottawa Electric Company, second vice-president; C. H. Mortimer, of the Toronto *Electrical News,* secretary-treasurer.

Executive committee: K. B. Thornton, superintendent lines of the Montreal Light, Heat and Power Company; A. A. Dion, superintendent Ottawa Electrical Company; B. F. Reesor, manager Electric Light and Power Company, Lindsay, Ont.; Chas. B. Hunt, manager London Electric Company, London; J. A. Kammerer, director of the Cataract Power Company, Hamilton; J. J. Wright, manager Toronto Electric Light Company; W. Williams, manager Sarnia Gas and Electric Company, Sarnia, Ont.; Lewis Burran, Quebec Railway, Light and Power Company, Quebec, Que.; H. O. Fisk, Peterboro (Ont.) Light and Power Company; J. W. Purcell, Hiram Walker & Sons, Walkerville, Ont.

The association decided to hold its convention next year at Niagara Falls.

Mr. K. B. Thornton, of Montreal, the retiring president of the association, and Mr. C. H. Mortimer, of Toronto, editor of the *Electrical News,* the secretary-treasurer, were untiring in their efforts to advance the interests of the association, and are to be felicitated over the very successful convention, and of the general awakening of the electrical interest which seems to have taken place in Canada during the past year.

Among others who were quite active in the work of the association were: Professor R. B. Owens, McGill University, Mr. C. F. Sise, Jr., of the Bell Telephone Company, and his brother Mr. E. F. Sise of the Northern Electric Manufacturing Company, and Mr. Alfred Collyer of Allis-Chalmers-Bullock, Limited, and Mr. R. E. T. Pringle.

The following were the attendants registered at headquarters:

MEMBERS AND VISITORS IN ATTENDANCE.

K. B. Thornton, president of the Canadian Electrical Association, Montreal Light, Heat and Power Company, Montreal.
A. A. Wright, M. P., president Electric Light and Power Company, Renfrew.
R. G. Block, superintendent Toronto Electric Light Company.
C. H. Mortimer, *Electrical News,* Toronto.
F. Thomson, F. Thomson & Company, Montreal.
A. B. Smith, superintendent of Great Northwest Telegraph Company, Toronto.
John Murphy, Ottawa Electric Company.
A. O. Dion, superintendent Ottawa Electric Company.
Gordon Henderson, superintendent Cataract Power Company, Hamilton.
B. E. Reesor, manager Georgian Bay Power Company.
E. A. Evans, Quebec Railway, Light and Power Company.
Charles B. Hunt, manager London Electric Company.
H. D. Bayne, Canadian Westinghouse Company, Montreal.
J. A. Kammerer, director Cataract Power Company, Hamilton.
J. J. Wright, manager Toronto Electric Light Company.
R. S. Kelsch, consulting engineer, Montreal.
F. Wilson Fairman, Dominion Wire Company, Montreal.
R. E. T. Pringle, the R. E. T. Pringle Company, Montreal.
C. F. Sise, Jr., Bell Telephone Company, Montreal.
J. M. Mackie, Laurie Engine Company, Montreal.
J. W. Gilmore, E. F. Phillips's Electric Company, Montreal.
E. A. Seath, John Forman, Montreal.
W. A. Patterson, Chapman Double Ball Bearing Company, Toronto.
Geo. C. Burnham, Allis-Chalmers-Bullock, Limited, Montreal.
F. B. Brown, Ross & Holgate, Montreal.

E. F. Sise, the Wire and Cable Company, Montreal.
Dr. R. B. Owens, professor of electrical engineering, McGill University.
H. J. Fuller, the Canadian Fairbanks Company, Montreal.
Wallace C. Johnson, consulting engineer Shawinigan Water and Power Company, Montreal.
W. F. Dean, Canadian General Electric Company, Montreal.
Alfred Collyer, Allis-Chalmers-Bullock, Limited, Montreal.
Charles W. Price, ELECTRICAL REVIEW, New York.
W. A. Duff, Canadian Westinghouse Company, Montreal.
John S. MacLean, Allis-Chalmers-Bullock, Limited, Montreal.
H. A. Burson, Allis-Chalmers-Bullock, Limited, Montreal.
H. A. Moore, Allis-Chalmers-Bullock, Limited, Montreal.
W. Bradshaw, Westinghouse Electric and Manufacturing Company, Pittsburg.
C. W. Bongard, the Wire and Cable Company, Toronto.
George A. Stanley, Canadian Westinghouse Company, Montreal.
H. Woodcock, Montreal Street Railway.
C. W. Henderson, Canadian Westinghouse Company, Montreal.
C. W. Johnson, Allis-Chalmers-Bullock, Limited, Montreal.
R. T. MacKeen, Canadian General Electric Company, Toronto.
R. M. Wilson, Montreal Light, Heat and Power Company.
A. Esling, R. E. T. Pringle Company, Toronto.
S. W. Smith, Canadian Westinghouse Company, Montreal.
T. F. Kenny, Allis-Chalmers-Bullock, Limited, Montreal.
H. H. Henshaw, Allis-Chalmers-Bullock, Limited, Montreal.
James J. Campbell, Jr., Canadian Westinghouse Company, Montreal.
W. V. Warren, Allis-Chalmers-Bullock, Limited, Montreal.
E. M. Breed, Canadian Westinghouse Company, Montreal.
R. E. Brandeis, G. M. Gest, contractor, New York and Montreal.
Alex. Barrie, the Wire and Cable Company, Montreal.
J. W. Purtell, Hiram Walker & Sons, Walkerville.
W. P. Ambos, Osborne Flexible Conduit Company, New York.
Robert J. Smith, Canadian Electric and Water Power Company, Perth.
George Bullock, Allis-Chalmers-Bullock, Limited, Montreal.
W. P. Roper, Canadian General Electric Company, Montreal.
Thomas Hilliard, Canadian General Electric Company, Ottawa.
E. P. Hannam, Canada Foundry Company, Toronto,
George C. Rough, Packard Electric Company, St. Catharines.
George H. Weaver, Dominion Foundry Supply Company, Montreal.
J. Herbert Hall, Conduits Company, Limited, Toronto.
P. G. Gossler, J. G. White & Company, New York.
Phelps Johnson, Dominion Bridge Company, Montreal.
Ormond Higman, chief electrical engineer, Inland Revenue Department, Ottawa.
T. H. Bibber, American Circular Loom Company, New York.
E. Irving, manager Sunbeam Incandescent Lamp Company, St. Catharines.
J. W. Pilcher, Canadian General Electric Company, Halifax.
C. C. Starr, Canadian Westinghouse Company, Halifax.
F. Rose, Canadian General Electric Company, Toronto.
W. H. Reynolds, Canadian General Electric Company, Montreal.
H. B. Douglas, Canadian White Company, Montreal.
H. C. Hitch, Canadian White Company, Montreal.
P. D. Rutty, Canadian White Company, Montreal.
Sheldon Cary, Jandus Electric Company, Cleveland.
J. A. Thibodeau, Pembroke Electric Light Company.
Louis W. Pratt, Brantford Electric and Operating Company.
E. I. Jenking, Canadian General Electric Company, Toronto.
H. O. Fisk, Peterboro Light and Power Company.
H. O. Hart Canadian Westinghouse, Hamilton.
N. S. Braden, Canadian Westinghouse Company, Hamilton.
B. F. Selby, Canadian General Electric, Toronto.
T. R. Price, Sunbeam Incandescent Light Company of Canada, Limited.
A. M. Wickens, Canadian Casualty and Boiler Insurance Company, Toronto.
P. H. Hoover, New York Insulated Wire Company, New York.
C. S. Stokes, Canadian Westinghouse, Montreal.
Nelson Grayburn, Montreal Street Railway.
John H. Webber, Montreal Rolling Mills, Toronto, Ontario.
W. Williams, manager Sarnia Gas and Electric Company, Sarnia, Ontario.
Paul F. Sise, Northern Electric Company, Montreal.
H. H. Scott, Canadian Electric and Water Power Company, Perth.
J. W. Campbell, Canadian General Electric Company, Toronto, Ontario.
Wm. A. Bucke, Canadian General Electric Company, Toronto.
Paul J. Myler, Canadian Westinghouse Company, Hamilton.
Eugene Waugh, General Chemical Company, New York.
David Trainor, Canadian Copper Company, New York.
J. D. Lachapelle, Richelieu & Ontario Navigation Company, Montreal.
C. W. Schiedel, manager Waterloo Electric Light Company, Waterloo, Ontario.
E. D. Brand, Berlin Electric Company, Berlin.
M. C. Hall, Berlin Electric Company, Berlin.
John Cochrane, Berlin Electric Company, Berlin, Ontario.
J. D. Hathaway, Wire and Cable Company, Montreal.
F. E. Barbour, New York Central Railway, Montreal.
E. R. Frost, Jacques Electric Company, Quebec.
J. M. Deagle, Cataract Electric Company, Cataract, Ontario.
A. B. Lambe, Canadian General Electric, Toronto.
D. E. Blair, Montreal Street Railway.
D. P. Burke, Ottawa & Hull Power Manufacturing Company, Ottawa, Ontario.
W. L. Macfarlane, St. Lawrence Power Company, Cornwall, Ontario.
C. H. Abbott, R. E. T. Pringle Company, Limited, St. John, New Brunswick.
R. B. Reid, Breadmore Leather Company, Toronto.
R. B. Hamilton, Packhard Electric Company, St. Catharines, Ontario.
W. C. Girard, Farnham Electric Company, Farnham, Province of Quebec.
G. R. Duncan, Montreal Pipe Foundry Company, Three Rivers, Province of Quebec.
Lewis Burran, Quebec Railway Light and Power Company, Quebec, Province of Quebec.
E. H. Leonard, Electric Engineering Company, Montreal.
D. McQuaid, Electric Engineering Company, Montreal.
Thomas H. McCauley, general superintendent municipal plant, corporation of Port Arthur, Port Arthur, Ontario.
F. S. Jones, superintendent Electric Light and Telephone Company, Fort William, Ontario.
Charles L. Farrar, Lakefield Light and Power Company, Lakefield, Ontario.
T. Beecroft, Barrie Electric Light Company, Barrie, Ontario.
H. G. Taylor, Montreal Street Railway.
W. G. Ross, Montreal Street Railway.
D. MacDonald, Montreal Street Railway.
L. Trudeau, Montreal Street Railway.
A. F. Byrd, Montreal Street Railway.
H. R. Lockhart, Montreal Street Railway.
R. M. Hannaford, Montreal Street Railway.
H. J. Chapman, Montreal Street Railway.
G. Boyer, Montreal Street Railway.
P. Dubec, Montreal Street Railway.
D. Robertson, Montreal Street Railway.
H. E. Smith, Montreal Street Railway.
T. W. Casey, Montreal Street Railway.
M. Neilson, Montreal Street Railway.
A. Gaboury, Montreal Street Railway.
W. M. Reid, Montreal Street Railway.
E. J. Bengough, *Canadian Engineer*, Toronto, Ontario.
F. S. Keith, *Canadian Machinery*, Toronto.
Bert Fogarty, Fogarty Brothers, Montreal.
S. Humphries, Electric Repair Company, Montreal.
F. A. Chisholm, St. John's Electric Light Company, St. John's, Province of Quebec.
C. Thomson, Fred Thomson & Company, Montreal.
W. D. Bird, Montreal Light, Heat and Power Company, Montreal.
Lacasse Rousseau, Canada Electric Company, Montreal.
T. D. Lonergan, Chateau Frontenac, Quebec,
H. Grandbois, St. Casimir, Province of Quebec.
J. Dick, Montreal Street Railway Company.
Philip M. Walder, representing the R. E. T. Pringle Company, Limited, Montreal, Province of Quebec.
J. A. Fletcher, the R. E. T. Pringle Company, Limited, Montreal.
W. P. Kearney, Packhard Electric Company, Montreal.
J. Sangster, Hamilton Cataract Power, Light and Traction Company, Power Glen, Ontario.
Frank P. Vaughan, electrical engineer and contractor, St. John, New Brunswick.
L. A. Herdt, McGill University, Montreal.
D. H. Hudson, Hudson Electrical Supply Company, Winnipeg, Manitoba.
Robert J. Mercur, Canadian Iron and Foundry Company, Montreal, Province of Quebec.
Henry C. Kelley, Turbine Engineering Company, New York.
John J. Yorke, chief engineer St. Lawrence Sugar Refining Company, Montreal.
F. Jno. Bell, Canadian General Electric Company, Montreal.
C. G. Keyes, Ottawa Electric Company, Ottawa, Ontario.
J. M. Robertson, Montreal Light, Heat and Power Company, Montreal.
W. E. Simmons, the Bracebridge Light and Power Company, Bracebridge, Ontario.
Milton Ney, Bracebridge Electric Light and Power Company, Bracebridge.
G. M. Wright, the R. E. T. Pringle Company, Limited, Montreal.
R. H. Balfour, Montreal Light, Heat and Power Company, Montreal.
G. Porteous, Canadian White Company, Montreal.
H. E. Blatch, Canadian Westinghouse Company, Montreal.
M. A. Sammett, Montreal Light, Heat and Power Company, Montreal.
J. M. R. Fairbairn, Canadian Pacific Railroad, Montreal.
W. B. Shaw, Montreal Electric Company.
Charles F. R. Jones, Wire and Cable Company, Montreal.
A. E. Sangster, St. Francis Hydraulic Company.
A. Sangster, Sherbrooke Power, Light and Heat Company.
H. G. Steele, secretary Pittsburgh Transformer Company, Pittsburgh.
Dermot McEvoy, Canadian Rubber Company, Montreal.
Thomas Rogers, Great North West Telegraph Company, Montreal.
James Johnson, Public Works Department, Ottawa.
H. W. Weller, Babcock & Wilcox, Limited, Montreal.
Fred Beck, Westinghouse Company, New York.
E. H. Hughes, H. W. Johns-Manville Company, Montreal.
W. J. O'Leary, W. J. O'Leary & Company, Montreal.
George H. Olney, E. F. Phillips's Electrical Works, Montreal.
R. F. Jones, Bell Telephone Company, Montreal.
Robert W. Hogg, Canadian General Electric Company, Montreal.
J. P. Thomson, E. F. Phillips's Electrical Works, Toronto.
C. G. Buck, J. A. Dawson & Company, Montreal.
S. A. Stephens, J. A. Dawson & Company, Montreal.
F. J. Parsons, McDonald & Willson, Montreal.
Thomas R. Fulton, E. Phillips's Electric Company, Montreal.
L. Rubenstein, Montreal Light, Heat and Power Company, Montreal.
T. J. Mullen, Allis-Chalmers-Bullock, Limited, Montreal.
J. S. Hartman, engineering department Canada Car Company, Montreal.
J. A. Burnett, Montreal Light, Heat and Power Company, Montreal.
J. Warren, Packard Electric Company, Montreal.
L. Denis, Quebec-Jacques Cartier Electric Company, Quebec.
J. A. Burns, Munderloh & Company, Montreal.
F. G. O'Grady, the Canadian Iron and Foundry Company, Montreal.
H. K. Deutcher, Allis-Chalmers-Bullock, Limited, Montreal.
Norman M. Campbell, Canadian Rand Drill Company, Montreal.
H. A. Hamilton, the Westinghouse Electric and Manufacturing Company, Pittsburg.
Alister Maclean, Robb Engineering Company, Montreal.
A. P. Doddridge, Quebec Railway, Light and Power Company.
Thomas F. Niven, secretary Otis Elevator Company, Montreal.
A. R. Henry, Ross & Holgate, Montreal.
W. McLea Walbank, vice-president Montreal Light, Heat and Power Company.
George S. Chester, Westinghouse Electric and Manufacturing Company, Pittsburg.
D. H. Wilson, American Locomotive and Machine Company, Montreal.
E. A. Rhys-Roberts, Dominion Bridge Company, Montreal.
J. Norman Smith, Ross & Holgate, Montreal.
P. R. Diamond, Canadian Bronze Company, Montreal.
J. E. Hutchinson, Ottawa Electric Railway Company.
A. J. Gorrie, Great Northern Railway, Montreal.
S. T. Callaway, Locomotive and Machine Company, Montreal.
F. H. Pitcher, Montreal Water and Power Company.
E. R. Carrington, Thiel Detective Company, Montreal.
Albert Maclaren, president James Maclaren Company, Limited, Buckingham.
E. S. Leetham, the Lievre Valley Power, Traction and Manufacturing Company, Buckingham.
Fred Hatch, Martin Manufacturing Company, Whitby.
C. A. Waterous, Waterous Engine Works, Brantford.
H. Stansfield Dodd, Dodd Electrical Company, Toronto.
W. M. Andrew, Canadian Westinghouse Company, Toronto.
A. H. Charles Dalley, Westinghouse Machine Company, Chicago, Ill.
E. Camp, W. J. O'Leary Company, Montreal.
A. L. Doremus, Crocker-Wheeler Company, Ampere, N. J.
Charles S. Powell, Westinghouse Company, New York.
Louis Yorston, Montreal Light, Heat and Power Company, Montreal.
Jno. M. Cox, Montreal Light, Heat and Power Company, Montreal.
H. B. Pope, Montreal Light, Heat and Power Company, Montreal.
R. N. Robbins, Sherbrooke Power, Light and Heat Company, Sherbrooke, Province of Quebec.
H. McPhee, Fred Thomson Company, Montreal.
Jos. Wood, Jr., Nova Scotia Steel and Coal Company, New Glasgow and Sidney Mines, Nova Scotia.
L. A. Howland, Reid Newfoundland Company, St. John's, Newfoundland.
N. Curry, Rose Curry Company, Amherst, Nova Scotia.
A. P. Horner, Canadian General Electric Company, Montreal.
A. N. Dufresne, St. Cesaire Hydraulic Company, St. Cesaire, Province of Quebec.
Thos. T. Renton, Campbell-Renton, Kingstown, Ontario.
S. B. Condit, Jr., Conduits Company, Limited, Boston, Mass.
Frank Marchand, St. Cesaire Hydraulic Company, St. John's, Province of Quebec.
F. D. Gillies, Montreal Light, Heat and Power Company, Montreal.
G. R. Jonghins, Intercolonial Railway, Moncton, New Brunswick
A. Lundberg, Canadian Society of Civil Engineers, Montreal.
R. H. Zaritz, Allis-Chalmers-Bullock, Limited, Toronto.
C. A. Ring, Royal Pulp and Paper Company, East Angus, Province of Quebec.
J. W. Blanchet, St. Cesaire Hydraulic Company, Montreal.
J. A. Picard, St. Cesaire Hydraulic Company, Montreal.
H. Laporte, mayor, Montreal.
M. K. Adams, Crescent Electric Company, Montreal.
A. S. Forman, John Forman, Montreal.
W. D. Hall, Grand Trunk Railroad, Montreal.
Geo. W. Sadler, Sadler & Howarth, Montreal and Toronto.
L. A. Casgrain, manager Chicoutimi Electric Company, Chicoutimi.
J. C. O'Brien, Canadian Electrical Association, Montreal.
C. Lesperance, Farnham Electric Light Company, Farnham.
A. J. Carroll, Phillips's Electric Company, Montreal.
W. A Walker, Phillips's Electric Company, Montreal

American Institute of Electrical Engineers.

Twenty-Second Annual Convention Held at Asheville, N. C., June 19-22.

THE twenty-second annual convention of the American Institute of Electrical Engineers was held at Asheville, N. C., June 19-22. The proceedings of Monday, the first day, were reported in the ELECTRICAL REVIEW of June 24. Tuesday morning's session was given over to railroad papers. The first to be presented was entitled "Three-Phase Traction," and it was read by Mr. F. N. Waterman, of New York. This was followed by a paper by Mr. C. de Muralt, of New York, entitled "Heavy Electric Traction Problems in Electrical Engineering." Mr. S. T. Dodd, of Schenectady, N. Y., read a paper entitled "Weight Distribution on Electric Locomotives as Affected by Motor Suspension and Drawbar Pull." As the presentation of these papers had consumed the entire morning, it was decided to hold a special session in the evening to complete the programme for the day.

In the afternoon a visit was paid to the Weaver Power Company's station near Asheville.

The special session was called to order at 8.30 in the evening, with Professor W. E. Goldsborough in the chair, and proceeded to the reading and discussion of the paper by Mr. William McClellan, of Philadelphia, Pa., on "The Choice of Motors in Steam and Electric Practice," and the paper entitled "Electrical Features of Block Signaling," by Mr. L. H. Thullen.

After the meeting adjourned a ball was held at the Battery Park Hotel.

At Wednesday morning's session papers upon electrical design were taken up. These were "Limits of Injurious Sparking in Direct-Current Commutation," by Mr. Thorburn Reid, of New York; "The Design of Induction Motors, with Special Reference to Magnetic Leakage," Mr. C. A. Adams, Green Harbor, Mass.; "Limitations in Direct-Current Machine Design," by Mr. Sebastian Senstius, and "A New Instrument for the Measurement of Alternating Currents," by Mr. E. F. Northrup. The paper entitled "Eddy Currents in Large Slot-Wound Conductors," presented by Mr. A. B. Field, was read by title.

In the afternoon excursions in special electric cars were made to various points of interest in and around Asheville, ending at the grounds of the Swannanoa Golf Club, where tea was served.

In the evening an enjoyable banquet was tendered the visiting members by the local members. The banquet hall was handsomely decorated with electric lights and a large illuminated Institute badge. The tables were decorated with rhododendrons and cotton plants. The following toasts were offered: "Our First Visit South," President John W. Lieb, Jr.; "Our Visitors," Mayor Alfred S. Barnard, Asheville; "The Institute," Dr. Schuyler S. Wheeler, president-elect; "Industrial Developments of the South," Mr. John H. Finney, of the local committee; "Our Technical Institutions," Dr. Samuel Sheldon; "Theory and Practice," Dr. C. P. Steinmetz; "Utilization of Natural Resources by Electricity," Dr. F. A. C. Perrine. The toastmaster was Mr. T. C. Martin, of New York.

Thursday morning's session took up papers describing new developments. They are as follows: "Water Powers of the Southeastern Appalachian Region," Dr. F. A. C. Perrine, New York; "Development of the Ontario Power Company," P. N. Nunn, Niagara Falls, N. Y.; "A New Induction Generator," by William Stanley and G. Faccioli, Great Barrington, Mass.; "A New Carbon Filament," John W. Howell, Newark, N. J.; "Note on a Simple Device for Finding the Slip of an Induction Motor," by Professor Charles A. Perkins, Knoxville, Tenn. The paper by Professor George D. Shepardson, of Minneapolis, Minn., entitled "Notes on the Power-Factor of the Alternating-Current Arc," was read by title.

In the afternoon special cars took the visitors to All Souls' Church, at Biltmore, where an organ recital was given. In the evening a smoker was held at the Albemarle Club.

On Friday morning special cars took the visitors on a trip to the beautiful lake Toxaway, in the Sapphire Country.

Although the attendance at Asheville was not as large as had been hoped, the meetings themselves were well attended, and the discussions full and to the point. The social entertainments were exceptionally enjoyable, as the local committee had spared no effort in providing for the comfort and pleasure of the visitors. All of the visitors were charmed with the beauty of the country, and with the hospitality of the citizens of Asheville. Everything that would add to the enjoyment of the convention was provided. Special cars were available when any trips were to be made. The Asheville Telephone Company, the American Telephone and Telegraph Company, and the Southern Bell Telephone and Telegraph Company authorized free service for the week over local and long-distance lines, before the hour of 10 A. M. and after 5 P. M. The Western Union Telegraph Company authorized free service to members of the Institute from June 19 to June 24, inclusive. The privileges of the Asheville Club, of the Albemarle Club, and of the Swannanoa Golf Club were extended to the convention. Those who contributed to the local committee fund for entertaining the visitors were the merchants of Asheville, Allis-Chalmers Company, American Circular Loom Company, American Telephone and Telegraph Company, Asheville Board of Trade, Asheville Electric Company, Biltmore Estate, Battery Park Hotel, Catawba Power Company, Coxe Estate, Gamewell Fire-Alarm Company, Gould Storage Battery Company, Pittsburgh Reduction Company, Southern Bell Telephone and Telegraph Company, Toxaway Company, Weaver Power Company, and the Westinghouse Electric and Manufacturing Company.

A resolution was offered by Mr. Carl Hering, which criticised our present forestry methods and asked that the situation be brought to the attention of the federal and the several state governments for consideration. The resolution was seconded by Dr. Perrine, who pointed out the seriousness of the problem and the futility of the present methods of protecting forests. The chief danger is from fire, and almost nothing is done to avoid this. It was passed.

Before adjournment, resolutions were passed thanking all those who had contributed to the entertainment of the visitors.

At the close of the business, President Lieb introduced President-elect Wheeler who was greeted heartily and the convention was then declared adjourned.

PAPERS AND DISCUSSIONS.

"HIGH-POWER SURGES IN ELECTRIC DISTRIBUTION SYSTEMS OF GREAT MAGNITUDE."

C. P. STEINMETZ.

In this paper Dr. Steinmetz gives a review, investigation and discussion of a high-power surge which occurred in the high-potential distribution system of the Manhattan Railway in New York city during the early days of its electric operation. The circuits to the eight substations are described, and the network characteristics detailed. The surging resulted in a complete shutdown of the power station twice within two days. The most characteristic feature was the enormous volume and relatively low frequency of the oscillating surge, which explained the severity of the destruction and its widespread extent. The matter is then

taken up mathematically, the phenomena of wave trains and the frequency of propagation along the circuit receiving careful attention. The burning out of the fuses of some 2,300-volt transformers without destruction of these transformers is explained by assuming that the high-pressure oscillation penetrated to these transformers, and that their primary pressure rose so as to bring the iron of the transformers beyond magnetic saturation and blow the fuses by excessive exciting current due to magnetic saturation.

"AN EXPERIMENTAL STUDY ON COMMERCIAL LINES OF THE RISE OF POTENTIAL DUE TO STATIC DISTURBANCES, CAUSED BY SWITCHING, GROUNDING, ETC."

PERCY H. THOMAS.

This paper discusses the formation and characteristics of electric waves causing changes of potential in a circuit at various points. It is often convenient to think of a charged commercial electric circuit as a long, stretched spiral spring that is being pulled in all directions, but in a state of equilibrium except for a certain motion representing the normal flow of current. If any of the supports of this spring, which are analogous to the insulation of the electric circuit, gives way, there will be a sudden release and motion of a portion of the spring, usually resulting in little disturbances of waves throughout its full extent, which, in turn, will produce mechanical strains at various points. Similarly, the electric circuit charged at the instant of the highest electromotive force with quantities of energy in the form of electric charges at all points where capacity exists, and in the form of magnetism at all points where inductance and current exist, will suffer a shock, and an electrical surging throughout different parts whenever any breakdown of insulation occurs, or other disturbance takes place that tends to change the distribution of the stored energy. The surging and oscillations resulting from a disturbance of equilibrium will continue until a new condition of equilibrium is established, and in doing so will cause a rise of potential above normal in some point or points of the system, if the discharges are of such a nature that, in accordance with any of the principles already laid down, a rise of potential should properly occur. Descriptions of the tests conducted on the transmission lines of the Telluride Power Company, the Missouri River Power Company, and the Utah Light and Power Company are given.

The discussion of these papers was opened by Mr. H. G. Stott, of New York, who outlined what had been done to prevent a repetition of the trouble studied by Mr. Steinmetz. During these disturbances one generator and thirteen cables had been put out of commission. No damage at all occurred at any of the substations. It had been found that the static ground detectors show a ground from five to twenty-five minutes before a short-circuit occurs. If there were but one or two cables, this indication would allow time for the faulty cable to be detected and cut out of service; but as, under the old arrangement, it would be necessary to telephone from the central station to the substations, and thus separate the cables one after another, and test them for grounds, and as this process takes several minutes for each test, it would only be by accident that the faulty cable could be taken out of service before the short-circuit occurred. With the thirty cables in use, the old method would take about three-quarters of an hour. It was therefore decided to ground the neutral point of the system. The question was raised, what would happen in this case to the lead sheathing of the cables should a short-circuit occur. To avoid any trouble here, resistances were put in series with the lead sheaths, these resistances being capable of carrying 1,000 amperes for six minutes. They have a resistance of about six ohms. An overload relay is also installed at each end of the feeders, so that, in case of a short-circuit, the faulty cable is picked out and the oil switches at the stations opened. It is hoped to put this protective system into service during the present week. Mr. Stott said that, in every case where a short-circuit occurred, the damage was done at a manhole, and that they had been led to the conclusion that it was due to arcs in the open air. In order to prevent, in every way possible, such arcs, these portions of the cable have been enclosed in iron boxes, leaving no part of the cable itself open to the air, and giving no opportunity for an arc to arise. No trouble at all had occurred in any of the ducts. Since this has been done, short-circuits have occurred on the feeders, but there has been no rise of potential brought about by them.

Mr. P. N. Nunn, of Niagara Falls, N. Y., said that the field of transmission and distribution of electric power is much behind other features of the work. Financiers are continually asking engineers what guarantees of success can be given. They are not satisfied with having examples of successful plants pointed out to them, but they wish to know exactly what these plants are doing, what difficulties they encounter, and how they are dealing with them. Service from electric power plants is more continuous and secure than any other power service, but this is not true of the transmission lines themselves. Originally it was the transformers which were held in doubt, but now they are safe and reliable. At one time the insulators were the limiting factor, and the point at which trouble occurred, but insulators are at the present time reliable. Taking the transmission line as a whole, there is a feeling of uncertainty, and while we know much of the theory of electrical transmission, we are deficient in the application. There is no means of cutting out sections of a large transmission system without endangering the entire system. Lightning is a trouble that can not be helped, but it is humiliating to cause a shutdown of an entire plant when one wants to cut out but one feeder. We must have a better working comprehension of the line disturbances we are setting up before we extend our lines, and we must have better apparatus for controlling them.

Mr. S. M. Kintner, Pittsburg, Pa., said that Dr. Steinmetz's theory has been borne out by his tests. He has obtained in the open air oscillating arcs which must have been caused by voltages two or three times as great as the impressed.

Dr. F. A. C. Perrine said that it was not evident that in suppressing the higher frequencies we will be able to protect lines in all cases, nor is it sufficient to prevent the formation of arcs in the open air. He mentioned a case in California where an oil switch was blown to pieces by an arc formed when it was opened. He spoke of another case in Hartford, Ct., where, during the test of a lightning arrester, a circuit-breaker was opened and resulted in putting out all the lights of the system. As lightning arresters become more and more perfect, the sudden stoppage of the heavy currents set up may lead to trouble. Dr. Perrine paid a tribute to the Telluride Power Company for the experimental work which it had allowed to be conducted on its lines. This has led to information of inestimable value to the transmission engineer. He said that Dr. Steinmetz's paper was practical and not theoretical, since it was based upon an actual occurrence. Mr. Thomas's paper showed the worst conditions which could occur under the conditions of the test, but if the latter had been worse, the former must also have been more disastrous. Dr. Perrine laid much stress upon the fact that there is no harmless static discharge. A static discharge always means a leak, and is apt to lead to trouble. It can be stopped by the use of better insulators.

Mr. H. W. Fisher, Pittsburg, Pa., said that it was possible to get a great rise of voltage without the formation of an arc in the air. This may even occur with a short length of cable, as he personally had observed.

Mr. John W. Lieb, Jr., New York, dwelt upon the fallibility of human operators. The safest precaution against the failure of the human element is secured by the introduction of interlocking gear, which will assist greatly in preventing disaster due to a thoughtless action. A complete shutdown of a large system is a serious matter, not only on account of the interruption to continuity of service, but because of the difficulty of starting the system again. Each substation must be communicated with and thrown on the system one at a time. To do this requires time, and the process should be practised, although it is almost impossible to do so. The New York Edison Company had an opportunity of testing the rapidity with which a large system can be started recently, when the electrical service in Dreamland, Coney Island, was supplied from the Manhattan power-house.

Dr. Samuel Sheldon, Brooklyn, N. Y., called attention to the change in resistance, inductance and capacity due to the high frequencies of the surges. He asked whether the resistance is not the controlling factor in such cases.

In closing the discussion, Dr. Steinmetz

said that the destructive element in the case considered was of low frequency, but that this would not have occurred had it not been for high-frequency surges.

Mr. Thomas did not think that the trouble described by Dr. Steinmetz had been caused by the rapid extinguishing and reestablishing of a heavy arc. He thought that there must be some other cause. He had been able to prearrange a circuit which would give results similar to those described by Dr. Steinmetz. Consider a three-phase generator supplying power to the bus-bars, from which two three-phase circuits were carried to transformers connected in delta. Let one of these circuits supply power to a rotary converter; the other being idle. If a ground occur on one conductor of the second three-phase line, and continue until the conductor is burned in two, and then the arc between the far end of the conductor and the ground be extinguished, the system will be unbalanced, and the heavy discharge taking place through the ground will set up a serious disturbance in the system. There will then be a large capacity fed through inductance to the ground. Assuming this condition to occur in the case described by Dr. Steinmetz, a calculation of the frequency shows that partial resonance would occur. This partial resonance would gradually build up the voltage, which would break down another cable and cut it out. The voltage would again build up until another cable broke down and was cut out. He believed that this was about what had occurred in New York. Mr. Thomas further pointed out the opportunity for error in judging the electromotive force which started the arc by assuming this to jump directly through the air. The spark may be started by a discharge from the insulator, which forms the arc, and which rises and bridges across a longer distance. If the explanation offered above were the true one, grounding the neutral would stop the trouble, since it would cause the defective cable to be cut out. Mr. Thomas said that one result of his paper was the following maxim: "Never allow single-pole protective devices to be used."

Dr. Steinmetz, replying to Mr. Thomas, said that while fuses had fallen into bad repute, recent tests with an oscillograph showed that fuses do not cause trouble when used in branch lines. He thought that engineers should consider the matter and allow them to be used in such cases, since they would thus effect a considerable saving of expensive apparatus. Mr. Thomas's paper shows that the surging was at the fundamental harmonic; that this surging was not the traveling wave which he had discussed. At Kalamazoo he himself had obtained oscillograph records of great surges of potential of a similar kind. His conclusion is that the arc was established by self-rupture. It opened itself with extreme suddenness. It was then reestablished, and again broke, and so on. This peculiar arc was described by the paper on "Non-Arcing Metals," read before the Institute in 1892 by Mr. Alexander Jay Wurts. The same condition exists in electrolytic interrupters. A discharge takes place through such low resistance that the voltage at the discharging point drops to zero. The arc then opens suddenly and remains open for some time. The sudden stoppage of the arc causes the potential to rise again, and the process is repeated. The frequency of these current impulses is determined by the time during which the arc persists and the time during which the arc is open. The first period depends upon the time required to heat the air and to cause an explosion. The second depends upon the time required to charge the condenser represented by the system through the inductance of the system to a breakdown voltage.

"THE CONSTANT-CURRENT, MERCURY-ARC RECTIFIER."

C. P. STEINMETZ.

In this paper Dr. Steinmetz gives first a general description of the mercury-arc rectifier. The operation of the mercury-arc rectifier is based on the phenomena of the electric arc to be a good conductor in the direction of the arc blast, but a non-conductor in the opposite direction, and so pass only uni-directional currents. In an electric arc the current is carried across the gap between the terminals by a bridge of conducting vapor consisting of the material of the negative or cathode, which is produced and constantly replenished by the cathode blast. An electric arc, therefore, can not spontaneously establish itself. Before current can flow as an arc across the gap between two terminals, the arc flame or bridge of vapor must exist—that is, energy must have been expended for establishing this vapor bridge.

A description is given of the rectifier system, and the characteristics of the system analyzed. Oscillograph curves of the constant-current rectifier are shown, and the paper is concluded by a mathematical analysis and calculation.

The discussion was opened by President Lieb, who said that the alternating-current arc lamp is not equivalent to the direct-current arcs, and that the rectifier described by Dr. Steinmetz promised to be of great service.

Mr. John W. Howell, Newark, N. J., believes that there is a large field for this application of the mercury-arc rectifier, which would enable direct-current arc systems to be operated from the three-phase supply system by means of a simple, inexpensive device.

Mr. Thomas held that the discharge through the lamp was not a true arc. He believes that the vapor contained in the mercury vapor lamps and rectifiers is rather an impedance to the flow of current than an assistance.

Dr. F. A. C. Perrine stated that the rectifying action of mercury vapors was discovered by Jamin in 1885, and that he himself had experimented with it in 1888. The new idea is the use of the mercury arc in an enclosed tube.

In closing the discussion Dr. Steinmetz said that the power consumed by such a system had been measured by alternating-current and direct-current wattmeters placed in series, and that the difference of the readings of the two instruments was so slight as to be negligible in practical operation. He held that an arc does exist in the rectifier, and upon this assumption he had succeeded in developing the apparatus. The rectifying action is not limited to mercury, but is observed with all metals.

"DATA RELATING TO ELECTRIC CONDUCTORS AND CABLES."

HENRY W. FISHER.

This paper discusses the characteristics of stranded cables and the phenomena of current flow in the conductors. Curves are given showing the heat-conducting properties of water, air and insulating compounds, the change of insulation and capacity with temperature for various forms of conductors, and other cable characteristics. It is difficult to predict at this time the maximum pressures that may be transmitted through cables in the near future. The experienced manufacturer can construct cables that will withstand very high pressures at the factory; but without subjecting such cables to pressures operating under working conditions for a long time, it is impossible to tell how they will withstand high pressures continually, and abnormally high ones occasionally. All cables which are to be placed underground should be provided with lead covers, because, even if the insulated conductor can be submerged in water for an indefinite time without breaking down under pressure tests, yet if an unleaded cable of the same material be placed in ducts, sooner or later some ingredient that will injure it will get into the ducts or manholes.

The discussion on this paper was opened by Mr. H. G. Stott, who complimented the author upon the departure from previous tradition which did not allow such information to be published. He asked why the capacity, when measured by alternating currents, was different from that when determined by the ballistic method, and what objection there would be to using either method. Mr. Stott said that the principle of placing conductors underground is good. It is only a question of how far it is safe to go with the voltages used for buried conductors. It would appear from the paper that the manufacturers are now willing to furnish cables for 2,300 volts, and that he was looking forward to the day when it would be possible to obtain cables for underground transmission systems at 50,000 volts. Mr. Stott said that he believed the day is coming when the underground method of transmission will be standard.

Dr. F. A. C. Perrine said that Mr. Fisher was correct in assuming that the current flowing in a stranded conductor followed the spirals of the strands. This puts a cable on a different footing from the solid conductor. It is easy to calculate the increased resistance for seven and nine-strand cables, but it is difficult to do so for cables having nineteen or thirty-

six strands, or more. Dr. Perrine said the table published by Mr. Fisher marks a distinct advance in cable manufacture. A few years ago an increase in the thickness of the dielectric above a certain point added nothing to its strength. Now it appears that manufacturers have got over this difficulty.

Dr. C. P. Steinmetz said that the increased voltage in cable transmission has not kept step with the overhead work. Eleven thousand volts is the highest used, except in a very few instances, and the possible increase indicated in Mr. Fisher's paper is exceedingly important. He pointed out that although the impedance of a cable will be increased by the addition of steel strands, as shown in Mr. Fisher's paper, this increase in impedance will not compensate for the distributed capacity, as the impedance is in series, and the capacity is in shunt. In fact, it will make matters worse for transmission work.

In closing the discussion, Mr. Fisher said that when the capacity is measured with a static machine, a sort of polarization seems to take place. When there is a great difference in the two figures for the capacity obtained, one by the ballistic method, and the other by the alternating-current method, the cable will heat when subjected to a high stress. The conductivity of a stranded cable in which the strands lie close together should be about ninety-eight per cent of that of a solid conductor of equivalent cross-section.

"METHODS OF MEASUREMENT OF HIGH ELECTRICAL PRESSURES."

S. M. KINTNER.

This paper briefly summarizes the various methods of high-pressure measurement at present employed. It points out the respective advantages and faults of these methods, and describes a new type of Westinghouse static voltmeter. Probably the most convenient method of high-pressure measurement is the one employing the ratio of the step-up transformer supplying the power. The pressure on the low-pressure side of the transformer is measured by the customary low-pressure instruments. The high-pressure value is obtained by multiplying this measurement by the ratio of transformation. Unfortunately, the pressure ratio is not accurately the ratio of the number of turns on the two sides, and the real ratio of pressure is not a constant, but is dependent upon the load and its character.

The use of an auxiliary transformer to reduce the high pressure to a value suitable for ordinary low-pressure instruments has been very successful within a certain range of pressure. The limits of the usefulness of such a transformer are soon reached with increasing pressures, on account of the size of the transformer required.

Special coils have been placed in the high-pressure circuit, in an endeavor to have them linked with the same magnetic flux as the high-pressure winding, and thus give an accurate and constant ratio. This method has met with only a limited degree of success. It is but little, if any, more accurate than the method of ratio from the low-pressure side. It is subject to certain errors due to the lack of uniformity of pressure induced per turn. This lack of uniformity is due to the leakage flux affecting some parts of the winding more than others.

The method of using a capacity in series with a current-operated voltmeter, the spark-gap method, the coronal formation method proposed by Professor H. J. Ryan, the optical methods, the method employing condensers in series, the voltage being measured across one or more, and the method of employing electrostatic meters, are, in turn, taken up and described.

In the new type of static voltmeter described, the most important improvement embodied consists in the method of its insulation, which is obtained by surrounding the active parts of the meter with a medium of greater dielectric strength than atmospheric air. Such a medium is supplied by various liquids and by gases under pressure. In some instances it is advantageous to work with the liquids under pressure. With this method of insulation the distance between the operating elements of the meter is greatly reduced. The distance between the elements and the case is also reduced, permitting of a reduction in the size of the instrument. There is a great increase in the actuating forces due to the reduction of the distance between the active parts. By the reduction of the distance between the active parts of the meter, a better form of scale for reading the pressure values is made possible. The improved insulation and reduction in size permit the use of a metallic containing-case, which screens the instrument from external charges. It also makes possible the operation of the instruments on circuits that are grounded, without any appreciable variation in the readings from those taken on underground circuits of the same pressure. The liquid insulation acts as a dampener, and renders the instrument nearly dead-beat, thus making it very easy to read. Having a higher specific inductive capacity than air, the liquid insulation gives a corresponding increase to the actuating forces. With the liquid insulation, by properly shaping the moving system, making it hollow, a buoyancy is obtained which relieves the bearings from the weight of the moving element. This greatly assists the restoring force in bringing the system to the proper position of equilibrium for each particular condition.

Dr. C. P. Steinmetz said that he was prejudiced against electrostatic instruments, as his experience has shown that they may be off thirty per cent. They are greatly influenced by neighboring bodies. He himself uses step-down transformers for high-votage measurements as they can not well be wrong. Readings may be taken with a low-reading voltmeter, which is not likely to be out. The instrument described promises to be a reliable static meter. However, it should be borne in mind that the spark-gap is the final court of reference, since it affords the only means of calibrating such instruments. Moreover, in testing for dielectric strength, the stress is proportional to the maximum voltage, and not the square root of the mean square value; hence this instrument should be used for such tests only when the wave form is known. The spark-gap method is accurate to from two to five per cent when needle points are used. The resistance in the circuit must be low, so as not to cause an appreciable drop of voltage at the points due to the leakage or brush discharges which always takes place across the gap. Shields are not permissible with the spark-gap method, and it is important that there should be no loose contacts, since a loose contact in the circuit behaves as an oscillator, setting up voltage oscillations which break down the gap.

Dr. Samuel Sheldon said that condensers can not be used satisfactorily to step down the voltage, because of the "soakage" which takes place in the dielectric. He had found that when using a static machine, the discharge points being small balls carried on rods projecting from larger balls, the breakdown voltage varied with the position of the gap relatively to the larger balls; also whether the gap was nearer to the positive than to the negative terminal.

Mr. H. G. Stott said that his company started testing cables by the spark-gap, but found it unreliable for its conditions. The company now uses an electrostatic voltmeter, which is calibrated by means of transformers.

Replying to the discussion, Mr. Kintner said that there had been no trouble whatever with the bearings, but, if desired, the distance between bearings could be increased considerably. The instrument is not intended for low-voltage measurements. When it is used it is not well to have a high resistance in series with it. He himself has never been satisfied with the spark-gap test, since the spark-gap merely indicates when a certain stress has been reached, and gives no indication of any lower values. When a step-down transformer is employed, the equipment is practically duplicated, since the transformer for lowering the potential for the instrument is about as large as the testing transformer.

"SOME COMMENTS ON REMARKS MADE BY COLONEL R. E. B. CROMPTON BEFORE THE INTERNATIONAL ELECTRICAL CONGRESS."

JOHN W. HOWELL.

This paper discusses the remark made by Colonel R. E. B. Crompton before the International Electrical Congress, at St. Louis, last September, to the effect that the majority of the London (England) consumers of electric current take their supply at pressures varying from 200 volts in London up to 250 volts at Glasgow. It was therefore considered that the question of 110-volt-220-volt systems was settled, and the British engineers, as represented by Colonel Crompton, com-

pletely disagreed with all the arguments advanced by both Mr. Torchio and Mr. Dow to the contrary. These remarks, states Mr. Howell, indicate that either the English companies' 220-volt lamps are very much better than those made or known in this country, or that the English makes of 110-volt lamps are very much inferior to those made here. Mr. Howell made a number of tests on an average of twenty-five lamps of various makes, bought in the open English market. Only those types of lamp which were considered of the first class were tested. Target diagrams were made, and an immense amount of data secured regarding the comparative illuminating and life values of the best English and American lamps. Mr. Howell's conclusions are that the tests indicate a general lack of information on the part of English consumers on the subject of quality and performance of lamps. It is not surprising that people who will continue to use lamps so poorly rated for volts and candle-power as these are would not appreciate the difference between 220-volt and 110-volt lamps.

There was no discussion on this paper, but to the question by Dr. Steinmetz as to the possibility of going to 220 volts, Mr. Howell said that there is an inherent difficulty in doing so with carbon, and at present he sees no prospect of overcoming it.

"THE PRESERVATION OF SOUTHERN STREAMS—A FOREST PROBLEM."

CHARLES E. WADDELL.

This paper discusses the conditions existing in the South at the present time. There are a large number of rivers which, if properly protected, will become valuable sources of power. The present method of forestry is rapidly changing the character of these streams, making them subject to floods and irregular flows. The land which has been cleared is greatly eroded by the rains, and its value thus much depreciated. The corrective for this evil lies in the proper preservation of the forests and the introduction of proper lumbering methods. The paper was illustrated by a number of lantern slides showing the effect of rains and floods on the country.

"THREE-PHASE TRACTION."

F. N. WATERMAN.

This paper discusses the application of three-phase traction, particularly with regard to some specific features, and analyzes some of the results attained and result which may be expected in practice. The adverse opinion which has been voiced before many technical societies regarding the use of three-phase motors for railway purposes is analyzed, and a direct comparison made of every essential with direct-current operation and operation with three-phase current. Mr. Waterman concludes that, with a small air-gap motor at twenty-five cycles, and with four-speed control, a great superiority in performance is shown, not only over the alternating-current motors used by Mr. Berg in his analyses some years ago of the Valtellina system, but also over the direct-current motors. On the same basis of weight, friction and schedule, and a much lower average acceleration, these motors take eighty-one per cent of the power required by the direct-current (at the switchboard); they have forty-seven per cent of the average losses in transmission, and cost 76.5 for the entire equipment, or fifty-six per cent for generating and distributing equipment.

Mr. W. M. Smith, Pittsburg, Pa., thought that the value of this paper is limited by the fact that it considers a single railway only. Although the three-phase system may be entirely successful on the Valtellina line, it is doubtful whether it could be applied with equal success elsewhere. The ability of a motor to start a train does not determine its suitability for railway work. Constant-speed motors can be made so as to start the train readily, but such motors are large. The motor should be designed for constant work, and not simply be made big enough. The three-phase locomotives are heavier, the gear problem is difficult, and two motors are required in place of one for other systems. During the time when the locomotive is running at full speed one of these motors is idle. He thought that a differentiation should be made between dead and live loads, and he is in favor of the single-phase system because of its simplicity.

Dr. Steinmetz took somewhat the same view of the paper. In his opinion the air-gap of the induction motors is too small, and it is out of the question to adopt frequencies as low as fourteen. Railway development to-day is proceeding along these lines: the road is first paralleled by trolleys; then these electric lines put on express cars and begin to take away business from the steam road; then the steam railway buys up the trolley roads, systematizes them, and electrifies portions of its own main line. The system adopted for the main line must accommodate itself to the existing electric systems. Dr. Steinmetz pointed out that a low-frequency alternating current will cause electrolytic trouble, and that the methods which have been employed for correcting this for direct-current systems will not prove satisfactory.

Mr. C. O. Mailloux thought constant speed and recuperation are of theoretical interest, but not of much practical value. It should be more desirable to go up the grades at a slow speed and to make up for the lost time by speeding on the level. With a three-phase system 3,000 volts is, in his opinion, the limit; but before heavy trains can be operated, higher voltages must be used. Six thousand is even too low, as it is desirable to go to 10,000, 15,000 or even higher. For this reason a single-phase system must be adopted.

Mr. S. M. Kintner, referring to the electrolytic troubles hinted at by Dr. Steinmetz, said that he has exposed a conductor to an alternating current of twenty-five cycles, twenty-five volts, for eight months, and had been able to detect no damage.

Mr. H. G. Stott pointed out that the cost of energy for a system is not proportional to the kilowatt-hours, but to the load-factor. It varies inversely as the load-factor.

Mr. C. de Muralt held that a large road would not be influenced by variations in load of a single locomotive. The question of weight is only one of degree. Heavy motors are required for ascending grades at high speeds. For the same heating effect and the same efficiency, an induction motor is better than a direct-current motor. It is not just to condemn the concatenation system because it is not always working at full load. The same is true for direct-current motors, since they are not always working at full power. The double overhead line is objectionable, but it is not prohibitive. He would be willing to put up a double line anywhere; and it is better to employ a voltage which will be safe for the insulation.

Mr. William Stanley said that induction motors are bad for the regulation of the system, and that neither induction motors nor commutator motors are adapted for the work. A system should be employed in which the frequency on the motor varies at the start. If a large number of induction motors should be started at the same moment, the effect on the regulation would be such that the power station would disappear as such.

Replying to the discussion, Mr. Waterman said that on the same weight rating, induction motors will heat less than the direct-current motors by fifteen per cent. The Ganz Company is now installing a three-phase system on a road near Milan, where the motors will run on the direct-current line within the city. They will accelerate as single-phase motors, and operate as three-phase motors. These motors are not particularly heavy. Contrary to opinions which had been expressed, the Valtellina line was not favorable for three-phase exploitation. In fact, it had been selected because of its unfavorable characteristics for this system.

"HEAVY ELECTRIC TRACTION PROBLEMS IN ELECTRICAL ENGINEERING."

C. DE MURALT.

This paper undertakes the equipment and proposed electrical operation of a regular trunk line system. From a point in the terminal city two lines branch out, both now operated by steam, but for which electric traction is proposed. One division is 175 miles long, of a regular trunk line system; the other division is an ore road forty-nine miles long. Both lines have single track, except at some of the stations, where a second track of about 3,000 feet in length is installed. The total track mileage for the first division is 182 miles, and for the second division, 52.5 miles. The physical conditions of the road are described, the various elements entering into the operation are taken up and analyzed, and cost-by-cost tables are made up, comparing equipment and operation with continuous current and three-phase current. It is difficult, states the author, to reach general conclusions applicable to all possible cases.

By following the line of reasoning laid out in this paper, it is seen that the advantages of three-phase, alternating-current traction may become somewhat less if the distances between stations are reduced and if the trains are made lighter, while, on the other hand, heavier trains and longer runs between stations make the advantages of the three-phase system even more pronounced; and wherever there are any long grades, the three-phase system presents the special advantage of relieving the power station by the energy returned from the descending trains. As regards traffic density, it may be said that the three-phase system is preferable for light traffic on account of the smaller first cost of installation; and for congested traffic, because the constant speed of the induction motor will permit the maintenance of a high-speed schedule even under abnormal conditions. The greatest advantage which can be secured in trunk line operation by the use of electricity in place of steam lies in the practically unlimited power which can be poured into an electric locomotive. This increased power can be used to haul far heavier trains than are now customary up steeper grades, and at higher speeds if desired. The technical characteristics of the three-phase alternating-current system are such as to make it preeminently suited for taking advantage of this situation, and its smaller cost of installation, with corresponding lower charges for interest, etc., allows the railway company to reap the full benefit of the resulting greater economy of operation.

In discussing this paper Dr. Steinmetz said that when great overload capacity was provided in a motor, the average power-factor and the average efficiency of the motor are poor. The same is true of the transformers, since they are normally operating at light loads. The design of the bearings is one of obtaining sufficient room. Returning power to the line does not smooth out the load diagram, as had been suggested. In fact, it makes it worse. Recuperation of power is only feasible when concatenation is employed, since it will not be allowable to run the locomotives above synchronous speed. Concatenation is inefficient and heats the motors, and at twenty-five cycles it is not worth while.

In closing the discussion, Mr. C. de Muralt said that the steam roads of this country are nearly at the limit of their capacity now, and they must provide for a great increase in the near future. There is no difficulty in obtaining room for large bearings in the induction motor. It takes no more room for bearings than it does for a commutator. Although most engineers object to two overhead conductors, he thought that the commutator was a more serious objection.

"WEIGHT DISTRIBUTION ON ELECTRIC LOCOMOTIVES AS AFFECTED BY MOTOR SUSPENSION AND DRAWBAR PULL."

S. T. DODD.

This paper analyzes the stresses produced in a locomotive propelled by electric motors. The motor action produces a set of stresses acting between the truck frame, motor supports and driving wheels. The horizontal effort at the rail head resulting from these stresses acts against the resisting forces of the locomotive, the principal items of which may be considered to be: (*a*) the rolling friction of the wheels on the track at the rail head; (*b*) the resistance to acceleration due to the inertia of the locomotive, and the resistance due to grade acting at the centre of gravity of the locomotive; (*c*) the air resistance acting at the exposed surface, particularly at the head end; (*d*) the resistance of the trailing load acting at the drawbar. Calculations are made for particular cases, and the formulæ developed for estimating the horizontal effort on the axle. A number of typical locomotives are described, the elements entering into their construction are analyzed, and formulæ developed giving the distribution of dead weight, the live weight, the drawbar, and the total live weight.

Due to the lateness of the hour there was no discussion of interest on this paper.

"CHOICE OF MOTORS IN STEAM AND ELECTRIC PRACTICE."

WILLIAM MCCLELLAN.

In the absence of the author the paper was read by Mr. E. H. Seaman.

This paper discusses the elements which make necessary widely different considerations in regard to the choice of motors in steam and electric locomotives. With an electric locomotive the power station is combined in a single element, which moves from place to place with the load. With the electric car the power station is at one end of the line while the moving load is sometimes far away. This makes necessary an entirely new set of considerations, which the electrical engineer has had to build up out of the experience of those who, for a long period before, were engaged in steam railroad practice.

The discussion was opened by Professor W. E. Goldsborough, New York, who thought that the paper was important, as it called attention to the early necessity of standardizing electric railway engineering. The electrical engineer must decide upon some form of electrical supply. This done, then a number of types of locomotive could be adopted, suitable to the various needs.

Mr. C. O. Mailloux took the opposite view. He held that we should not standardize until we have more nearly perfected our machines. Too early standardization is harmful, since it retards progress. Some standardization can be adopted with benefit, such as gear ratios and interaxial distances.

Dr. Steinmetz could not agree with the suggestions to standardize. His view was rather: "let us not unstandardize, but use what we have that is good." The number of gear ratios existing can not be helped as it is necessary to use as many teeth on the pinion as possible to reduce the wear. When ratios differ but slightly, they are practically the same ratio, the slight difference being necessary to accommodate the different sizes of motor.

Mr. Stott pointed out that in steam-engine design we are still far from standardization after sixty years of progress. He thought that the paper was presented half a century too soon.

"ELECTRICAL FEATURES OF BLOCK SIGNALING."

L. H. THULLEN.

In the absence of the author, the paper was read by Mr. F. G. Proutt, of Memphis, Tenn.

In the past few years electricity has come steadily into use as a means of transmitting and operating power, until, at the present time, it is the prime element in signaling. The paper gives a brief sketch of the older methods of signaling, taking up the telegraph block system, the lock and block system, automatic block signaling, the track circuit, the system on the Boston Elevated Railroad, the more recent system installed on the North Shore Railroad in California and in the New York subway. The light signals used in the East Boston tunnel and in the electrified subway portion of the Long Island Railroad are also described.

Mr. H. G. Stott complimented the engineers who had installed the system in the subway. The details and complications are exceedingly great, and the ingenuity displayed was remarkable. The record obtained in its operation was one failure for 300,000 performances.

Mr. F. N. Waterman compared the record of performance with that of the Pennsylvania block system, which had previously held the record—70,000 performances to one failure.

"LIMITS OF INJURIOUS SPARKING IN DIRECT-CURRENT COMMUTATION."

THORBURN REID.

The author has advanced the hypothesis that the injury done by sparking at the brushes of a direct-current dynamo is not due to the current jumping across the gap between the segment and the brush, but is done while the brush is in contact with the segment, the copper of the segments being first melted and then volatilized by the concentration of current energy at one or the other of the segment edges. Perfect commutation is also defined as such a change in the current in the coil under commutation that the current density over the contact surface between the brush and the segment is constant and uniform. Perfect commutation will result if the coil impedance be negligible as compared with the brush contact resistance. In order to make this whole subject clearer, and also to render this principle applicable to practical commutator design, the author considers in detail what happens to a commutator segment while the machine is running. This is an analytical study of the phenomena involved, the conclusions of which are arrived at by distinctly mathematical reasoning.

The discussion was opened by Mr. Gano S. Dunn, of Ampere, N. J., who said that the theory of commutation which had been advanced by Mr. Reid some years ago was

not complete, but it is the most satisfactory so far offered. It, however, does not explain all phenomena. He has not been able to account for the energy required to volatilize copper during commutation. Brushes newly fitted to the commutator usually give satisfactory service, but after running for a time it will be found, if the commutator is blackening, that the brushes are being cut away at one edge, and that this cutting action is traveling back under the brush. This may give rise to sparking, which will not be detected unless carefully looked for. Such brushes will be polished where they rest upon the commutator, and dull toward the edge. Mr. Dunn described a new type of brush recently brought out, which introduces a new principle in intercommutation. In this the collecting brush is supplemented by a second small carbon brush, mechanically supported by the first, but insulated from it. During commutation this small brush short-circuits each coil successively for a short time, and during this period the current flows from one commutator segment into this auxiliary brush back to the next commutator segment, and then up to the main brush. There are thus three contact resistances in series. The brush has given excellent results.

Dr. C. P. Steinmetz said that the resistance of the contact has the characteristics of the arc. The curve plotted between the voltage drop across the contact to the current flowing is similar to a saturation curve. It rises approximately as a straight line, and finally seems to reach a limited value.

Mr. W. L. Waters, Milwaukee, Wis., said that the damage to commutators is due to the energy density. The suggestions made were valuable, but he thought that Mr. Reid's formulæ were too complicated to be of much practical value to the designer.

Mr. Reid, in reply to the discussion, said that the deposition of copper on the brushes was due to volatilization; that it was possible to have the energy density fourteen times as great as the average, which is sufficient to cause volatilization. Although it is well known that the contact resistance varies, it is impossible to allow for this in the formulæ. He said that the equations which he has deduced are used indirectly at the present time.

"THE DESIGN OF INDUCTION MOTORS, WITH SPECIAL REFERENCE TO MAGNETIC LEAKAGE."

C. A. ADAMS.

At the last International Electrical Congress, at St. Louis, the author presented a paper on "The Leakage Reactance of Induction Motors." In this a new leakage element was described, with the results of experiments and calculation. A method of calculating the other leakage elements was also outlined. In the present paper this method is more fully developed and applied to the design of induction motors.

Mr. W. L. Waters said that it is impossible to reduce designs to an exact science. Variations will occur. It must not be forgotten that in induction motors the air-gap may easily vary ten per cent in the same lot of machines. There is a greater difference between the open and the closed slot than is allowed for. The method of calculation is too complicated for designers. A difference of five per cent in the power-factor may mean all the difference between an expensive or cheap machine. He thought that the paper was of more value as a general treatment of the subject than as one dealing with the details of design.

Dr. C. P. Steinmetz did not agree with Mr. Waters as to the great complexity of the formulæ offered. He pointed out that a difference of five per cent in the power-factor is of great importance, since the operation under average conditions must be considered.

Mr. Adams, in replying, said that while the air-gap of individual machines would vary, the average gap should be taken, and that the results offered would fit the average machine. The calculations are not difficult, and a few moments' work on paper would enable one to predict accurately the performance of any particular design.

"LIMITATIONS IN DIRECT-CURRENT MACHINE DESIGN."

SEBASTIAN SENSTIUS.

This paper presents a system of design based directly upon general experimental data and the commercial guarantees of the machines. It deals with the limitations imposed upon the development of large machines by the quality of brushes obtainable. The problems involved have not been attacked from the point of view of the physicist, but from that of the engineer. They are considered under the following heads:

Reactance pressure: (1) reactance pressure of the single-commutator machine; (2) reactance pressure of the double-commutator machine.

Commutator and brush sparking, spitting, glowing and picking up of copper: (1) probable causes; (2) experimental data.

Designing an armature.

Conclusions: (1) discussion of the formulæ; (2) limiting sizes of direct-current machines; (3) note on direct-current turbo-generators.

Mr. Gano S. Dunn did not agree with the paper in the limit set for direct-current machines. Eleven hundred and seventy-five kilowatts is too high for a 125-volt machine. Eighteen hundred kilowatts is about right for 300 volts, and 1,450 kilowatts is too low for 600-volt machines.

Mr. W. L. Waters agreed with Mr. Dunn, and referred to two 600-volt machines running in Boston. These are rated at 2,200 kilowatts, and carry easily 4,000 kilowatts. He believes that it is entirely feasible to build 600-volt, direct-current machines for 5,000 kilowatts.

Dr. C. P. Steinmetz took the same stand. He instanced a 250-volt machine rated at 5,000 horse-power which is operating successfully. He called attention to the fact that the equations for armature reaction were applicable only to full-pitch windings, and would have to be modified for fractional pitches.

In reply to a question, Mr. Dunn said that the deposit of copper on the brushes is effected by the polarity of the current, the copper traveling with the current. When this film is formed it seems to collect into a small bead, and trouble then begins.

In reply, Mr. Senstius said he had not seen the larger machines referred to, but their performance should be compared with that of smaller machines. He mentioned a number of large machines at Cincinnati, which always spark during operation, and pointed out that the limits which he had set were for a machine in which the brushes were not to be shifted during changes of load.

"A NEW INSTRUMENT FOR THE MEASUREMENT OF ALTERNATING CURRENTS."

E. F. NORTHRUP.

This paper describes in detail the electrical and mechanical features of a new instrument for the measurement of alternating currents. The instrument and methods of measurement were developed to meet the frequent need of means for easily and accurately calibrating alternating-current instruments, whatever their capacity. It also suggests an inexpensive method of measuring, with high precision, very large alternating currents, regardless of their wave-form or frequency.

This paper was discussed briefly by Messrs. H. W. Fisher, Morgan Brooks, H. G. Stott, and C. W. Perkins, who felt that the instrument would be of much service in practice.

Mr. Northrup exhibited an equipment suitable for measuring currents up to 300 amperes, and referred to the suitability of this instrument for high-frequency work. He had succeeded in measuring the current from a high-frequency machine after it had passed across a half-inch spark-gap.

"EDDY CURRENTS IN LARGE SLOT-WOUND CONDUCTORS."

A. B. FIELD.

This paper discusses the more important causes of eddy currents in heavy conductors carrying alternating currents surrounded on three sides by iron. In the case in which the slots are in the periphery of a circular core, and there is a more or less radial field rotating relatively to this core, as in direct-current armatures, stators of alternators and induction motors, potential regulators, etc., the causes of the eddy currents may be conveniently divided into two general classes, comprising (1) those involving directly the current in the conductor itself or in conductors in the same slot; (2) those involving magnetic flux due directly to external agencies. The nature of the current effects and magnetic effects in the coils is analyzed, and methods of eliminating these are given.

"MOTOR-GENERATORS AND SYNCHRONOUS CONVERTERS."

W. L. WATERS.

Motor-generators and synchronous converters can be discussed from two points

of view: that of the operating engineer, and that of the designer and manufacturer. The main points that concern the engineer when installing transforming machinery are the first cost of the machinery and its reliability and flexibility of operation. Incidentally the efficiency of the outfit, the floor space which it occupies, and sundry other things have to be taken into consideration. The cost of a motor-generator or synchronous converter —or, rather, the price at which it is sold by the manufacturer—depends upon the output and the speed and, incidentally, upon the competition of firms that are trying to secure the business. The paper gives tables of the cost, efficiency and floor space needed for synchronous converters and motor-generators of different outputs, and analyzes the cost and efficiency of the synchronous converter and transformer outfit as against the motor-generator. The question as to which type of machine ought to be used in any given case can only be decided after every feature of the situation has been duly considered. Broadly speaking, however, the tendency to-day is toward motor-generator sets in lighting systems, and synchronous converters in traction systems. This seems, perhaps, to be the most rational conclusion. Motor-generators and synchronous converters, all things considered, are really considerably more difficult to design and build than the ordinary standard engine-type generator. They are high-speed machines, and usually run in substations where the conditions of operation and supervision are not of the best.

The discussion was opened by Mr. Gano S. Dunn, who said he was glad to see attention directed once more to the motor-generator. He asked what effect fluctuating loads had upon the excitation of the motor-generator set.

Mr. F. G. Proutt thought that for this purpose induction motors were preferable to synchronous motors, as they were less liable to be thrown out of service by carelessness of the attendants.

Dr. C. P. Steinmetz said that the motor-generator is preferable to the synchronous converter for frequencies of sixty cycles per second, and for small units at lower frequencies, but for larger units at low frequencies the synchronous converter is the better. For these machines a high armature reaction is to be preferred as it gives greater stability and reduces surges on the line.

Mr. H. G. Stott thought that the regulation is better with synchronous converters than with motor-generators.

Professor Morgan Brooks, Urbana, Ill., wished to know whether the chances for pulling through difficulties were not better with the motor-generator than with the synchronous converter.

President Lieb said that when rotary converters were first installed by the New York Edison Company, three or four of them had been wrecked for lack of a good speed-limit device. At the present time there is no further trouble from this source, and these devices have frequently saved the machines, and have brought confidence back to the operators who now let the rotary converters hang on to an overloaded system longer than they would have dared previously. At the present time the company experiences no difficulty with about 50,000 kilowatts in converters operating in parallel on its system.

In reply, Mr. Waters held the opinion that rotary converters are better for meeting overloads, but their field of application is limited to railway work.

"WATER POWERS OF THE SOUTHEASTERN APPALACHIAN REGION."

F. A. C. PERRINE.

This paper discusses the topographical characteristics of the southeastern Appalachian region. The Appalachian mountains are neither as high nor as rugged as either the Sierras or the Rockies. Their tops are approximately on a level with the plateau between the Rockies and the Sierras. Most of these tops are rounded hills covered with earth and vegetation to their summits. None of them reaches to the snow line. They form, however, the fountains for watering fertile plains below, which on both sides lie at their base. The chain extends from Maine to the Gulf, and comprises the White and the Green mountains of the north, the Adirondacks and Alleghenies in the Middle States, and the Shenandoah, Green Brier, Blue Ridge, Black and Great Smoky mountains of the South, with many auxiliary ranges. In the states of Virginia, North Carolina and South Carolina they lie massed on the western border and about the northern border of Alabama and Georgia, and form the eastern boundary of Tennessee, Kentucky and West Virginia. In this paper the writer confines himself to the consideration of the powers in the states of Virginia, North Carolina, South Carolina, Georgia and Alabama. On account of the physiographical characteristics, this region is preeminently a water-power country. The rainfall over its entire extent is in no part less than an average of thirty-five inches, increasing to sixty inches in the mountains. This precipitation does not occur in a wet season of limited duration, but is well distributed throughout the year. The soil itself is generally porous, and for those streams from the head waters of which the forests have not been cut the rainfall is retained, and neither the floods nor the low waters are as serious difficulties as are encountered in the Middle States. Ice and snow are not important elements in the problem, which is not only a condition favorable to hydraulic developments, but also to the problems of transmission line maintenance. The principal rivers of the southeastern Appalachian region, whose drainage basins need to be considered in studying the water-power opportunities offered, are the James, Roanoke, Staunton and Dan rivers in Virginia; the Cape Fear, the Jadkin and Catawba in North Carolina; the Catawba, Broad, Saluda and Savannah in South Carolina; the Oconee, Ocmulgee, Flint, Chattahoochee rivers in Georgia, and the Tallapoosa, Coosa, Tuscaloosa and Tombigbee rivers in Alabama. In this watershed there have been reported sites for power development aggregating 150,000 horse-power, many of the sites being within close competitive distance of each other. The conditions, on the whole, are favorable to the development of water power on a large scale, but point to the necessity for effective management and a comprehensive plan for the development of a section of territory rather than of a single power.

The discussion was opened by Mr. R. W. Pope, who suggested that the southern water powers might find a field of application in operating the Southern Railway systems.

Mr. C. E. Waddell, Biltmore, N. C., referred to the growing use of southern water powers for operating cotton mills. The climate is advantageous; there is no trouble with ice. The labor in that section is good, and is improving steadily. There is at the present time a lack of finishing mills in the South, and it is necessary to ship the woven product North for finishing. Along the Southern Railway alone there are a thousand cotton mills in operation to-day. The electrical supply companies are already making encouraging rates to cotton mills. The problem of developing water powers in the South at the present time is principally a financial one.

Professor L. S. Randolph, Blacksburg, Va., called attention to one feature of southern water powers. The time of minimum flow is variable in different sections. On some rivers it occurs during the winter, on others the low period is in midsummer. Dr. Perrine's paper did not deal with all of the power, since the streams back of the mountains offer good oportunities for development.

Mr. Weaver, of Asheville, said that the water power of the southern Appalachian is of more value than the important coal fields which they contain. The French Broad river is particularly valuable. It falls 900 feet, and never rises more than seven or eight feet during the worst floods. It drains a thousand square miles of territory. On the Atlantic side of the mountains the rivers frequently rise thirty-seven feet. The nearer the mountains, the greater the fall, and the quicker the run-off; but there is no trouble from back-water. The climatic conditions of this section of the country are excellent—almost ideal for cotton manufacture. The humidity is just about right, and the climate is equable and conducive to the finest cotton spinning. The freight rates for the section are not more than must be paid on the coast, since for the best products the long staple of the Mississippi valley is used. The workmen in that section are good and independent.

Mr. A. M. Schoen, of Atlanta, Ga., said that the most serious problem confronting this section of the country to-day is the destruction of the forests which is going on.

In closing, Dr. Perrine said that he knew of no stream in which the minimum flow occurs during the winter. Non-uni-

form rainfalls do not mean unusual variations in the run-off. During a dry summer there is generally less variation in the flow of the rivers, since the vegetation is killed, and less water is taken up by it.

"A NEW INDUCTION GENERATOR."

WILLIAM STANLEY AND G. FACCIOLI.

This paper discusses some of the elementary phenomena found while studying the performance of alternators excited by alternating currents. In a future paper the author intends to deal with the practical application of the principles here described. The alternators to be considered have their rotors and stators wound with distributed windings. The rotor circuits are supplied with very low frequency multiphase currents. These currents produce a field or fields which move around the rotor at a speed proportional to the frequency of the magnetizing or exciting effort. If the connection of the multiphase exciter circuits is such as to produce a clockwise magnetic rotation of the field (rotor), the rotor structure of the alternator may then be mechanically revolved either in the same or in an opposite direction.

The discussion was opened by Dr. C. P. Steinmetz, who said that the machine described by Mr. Stanley might be considered as a frequency-changer.

Professor Morgan Brooks asked whether the machine might not be used as a variable-speed induction motor.

Professor Goldsborough asked whether there was any great necessity for constructing machines having perfect regulation, since on large systems any disturbing factor is small in effect.

Replying to some of the questions, Mr. Faccioli said that the machine had been tested with power-factors varying from unity to 0.2. Throughout this range it regulated from a two-per-cent rise to a four-per-cent fall in voltage. The machine had not yet been operated as a motor. The exciter can be constructed to give any frequency desired, and the same machine may be used for different frequencies. The machine has two sources of energy, and may be designed so as to be independent of the power-factor of the system.

"THE DEVELOPMENT OF THE ONTARIO POWER COMPANY."

P. N. NUNN.

The generating station of the Ontario Power Company is located at the foot of the cliff forming the right-hand wall of the gorge. High above and behind the power-house, upon a bluff overlooking both the gorge and cataract, and by far the most prominent landmark on the Canadian side, is the distributing station of the company. Hidden away behind the trees of Goat Island are the walls, abutments and buildings of the intake and head-gates, through which the water from Niagara river is diverted for use below at the generating station. From the head-gates of the Ontario company three great steel and concrete tunnels convey nearly 12,000 cubic feet of water per second to the top of the cliff above the power-house. Thence it passes through twenty-two steel penstocks in shafts and tunnels down and out through the cliff to an equal number of horizontal turbines in the power-house below. From the generators the electrical cables turn back through tunnels to twenty-two banks of switches and instruments of the distributing station above, and to the transmission lines beyond, completing an equipment for more than 200,000 horse-power. The intake works for the entire 200,000 horse-power are now finished. One of the three main conduits is completed, while for the second and third, portals and head-gates have been installed, and a portion of the excavation made. Six of the twenty-two penstocks are already in place, with their shafts and tunnels, and two others are building; while the power-house is nearly prepared for the concomitant apparatus. The engineering features of this power development are given in detail.

In reply to several questions, Mr. Nunn said that there is no need now to worry about the water question; that although to the power plants located at Niagara Falls about twenty per cent of the water in the river has been ceded, less than half of this would be used. He called attention to the fact that the variation of the river from day to day is nearly forty per cent, and this is not noticed by any except the engineers. For this reason there need be no fear of the power plants upon the falls. He found it necessary in the plant he described to have two responsible operators—one a mechanical engineer at the generating station, and the other an electrical engineer at the distributing station. He could not predict how much trouble this plant would have in winter from ice, but if it should be excessive, the water in the forebay would be floored over.

"A NEW CARBON FILAMENT."

JOHN W. HOWELL.

The filament described by Mr. Howell is formed by heating to a high temperature in an electric furnace a treated carbon filament. The action does not affect the base of the filament, but seems to convert the shell into a new form of graphite having remarkable characteristics. The filament can be operated at an efficiency of two and one-half watts per candle, its temperature coefficient of resistance is positive. The graphite shell, when stripped off, is quite elastic, resembling a metal, hence the term "metallized" filaments for designating the new type.

President Lieb said it seemed that at last we have a two and one-half-watt carbon lamp, and that this would give to the incandescent lamp an advantage as great as that brought to the gas light by the incandescent mantle.

Mr. H. N. Potter, of New York, said that this paper seemed to be the reply of carbon to the metals—the turning of the carbon worm, as it were. He asked whether the change in carbon was not the production of a polymorphous form, whether the chemistry of the new filament had been worked out, and whether any life tests had been made. Would not the filament be longer than the ordinary carbon?

Replying, Mr. Howell said that the filament would be shorter rather than longer than the ordinary carbon filament. The chemistry is complex, and not fully worked out. The base of the filament is not changed by the treatment, but the graphite shell is changed, and this change seems to be almost independent of time, and takes place as rapidly as the filament can be passed through the furnace. The characteristics of this lamp are the same as those of the ordinary carbon lamp, but the life is longer. The indications are that we will not stop with a two and one-half-watt lamp, but can do much better.

"NOTE ON A SIMPLE DEVICE FOR FINDING THE SLIP OF AN INDUCTION MOTOR."

CHARLES A. PERKINS.

The device consists of a strip of sheet iron clamped at one end of an iron base, leaving the other end free to vibrate. An electromagnet is mounted on the same base, with its pole near the free part of the strip. When an alternating current is passed through the electromagnet in series with one or more lamps, the strip will be thrown into vibration, if it has about the same period of vibration as the driving current. The adjustment of the time of vibration of the strip is readily made by giving it such a length as shall cause it to vibrate a little too rapidly, and then loading it by a small copper wire which may be slid along the strip until approximate synchronism is obtained. On the shaft of the motor is placed a cardboard disc, pierced by as many equally spaced holes as there are north poles on the motor. The iron strip, with the electromagnet, is now placed in a good light and set into vibration by the supply current, and viewed through the holes in the rotating disc. If the holes come at each revolution in front of the eye when the current is in a certain phase, the vibrating strip will also be in the same phase at each view, and will apparently be standing still. As the motor slips backward, the strip is seen at successively later phases of its vibration, and seems to be slowly vibrating, making one complete vibration when the motor has lost one complete cycle.

"NOTES ON THE POWER-FACTOR OF THE ALTERNATING-CURRENT ARC."

GEORGE D. SHEPARDSON.

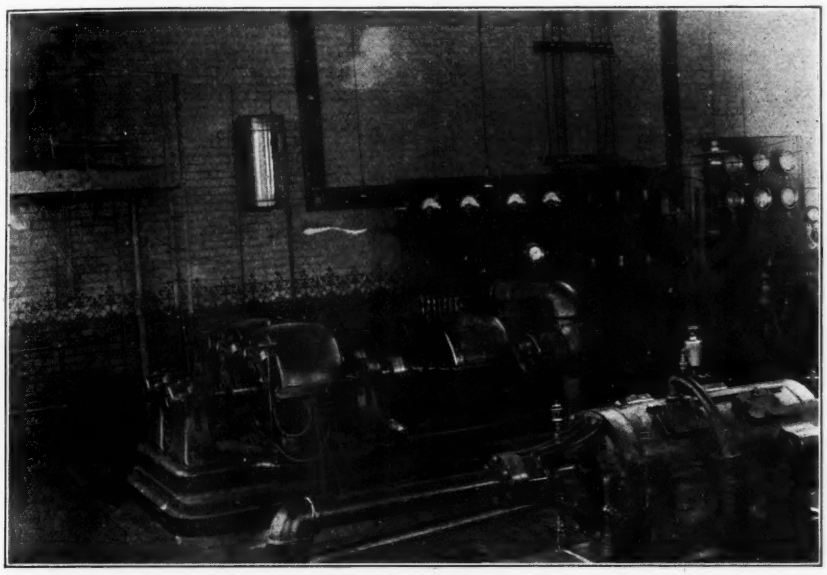
This paper discusses the effect of the wave form of electromotive force applied to the terminals of a standard enclosed arc lamp, and the elements affecting the power-factor. Oscillograph curves are shown. The hard carbons show a much more sudden rise in the difference of potential around an arc than do soft cored carbons or soft solid ones. A characteristic of the soft cored carbons is the secondary peak on the arc potential curve, occurring nearly simultaneously with the maximum current value, and thereby raising the power-factor.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

Test of a Steam Turbine After Having Been in Service for Two Years.

There has been quite a discussion of late in the technical papers in regard to the probable deterioration of steam turbines after having been in actual service a number of years, and the effect of same on the steam economy of the machine. On account of the comparatively recent introduction of the steam turbine into this country the information in this line has been more or less meagre, although this is not the case in Europe. The results obtained by Professor Edward F. Miller and R. R. Lawrence of the Massachusetts Institute of Technology, in tests made recently on a 150-horse-power steam turbine dynamo set, which has been in service at the New England Structural Company, East Everett, Mass., for the past two years, will be of particular interest.



STEAM TURBINE PLANT, NEW ENGLAND STRUCTURAL COMPANY.

Shortly before the test was made the turbine was taken apart and thoroughly examined as regards wear, etc., photographs being taken of the turbine wheel, buckets and pinion, which are reproduced herewith, and by examining the same it will be noted that the wear on all these parts is practically nil. A copy of a letter from the New England Structural Company, relating to this subject, reads as follows:

"We beg to advise you that the two steam turbine generators purchased of you about two years ago have proved very satisfactory in every way.

"The wheel and pinion of which photographs have been taken have been in constant operation for over a year and a half, and there is no trace of wear appreciable on the pinion or the buckets. In fact, many of the latter still have some part of the original scale made during the process of drop forging."

This machine is one of a pair which were built by the De Laval Steam Turbine Company at its Trenton, N. J., shops in the spring of 1903, both machines having been constantly in service for the New England Structural Company, East Everett, Mass., for furnishing power and light for its entire plant. A photograph of the installation is also reproduced herewith.

These machines were ordered under the following steam guarantees:

With 150 pounds steam pressure at governor valve and a twenty-six-inch vacuum at the turbine, 18.7 pounds of steam per brake-horse-power per hour at full load, and 19.7 pounds at half load.

By comparing these figures with those just obtained by Professor Miller and Lawrence, it will be noted that the turbines are still well within their original guarantees, thus proving that the deterioration, if any, has apparently not affected the steam consumption.

The test took place June 11 last, starting at 9 A. M. and finishing at 6 P. M., after which the electrical heat losses were obtained in order to determine the absolute brake-horse-power.

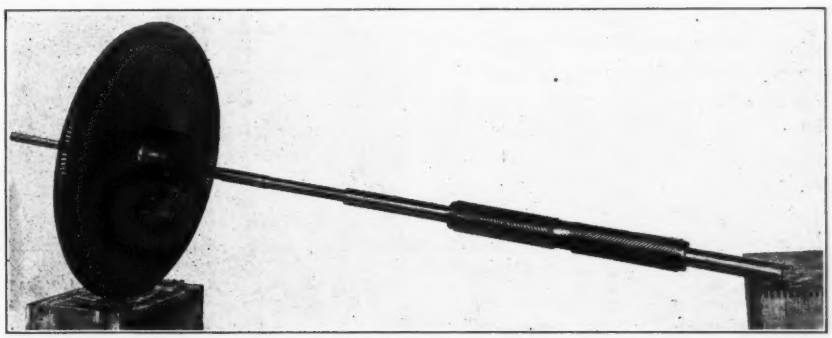
The steam supplied to the turbine under test came from one boiler. Steam for the auxiliaries and for the feed pump supplying this boiler came from a second boiler.

All condensation in the steam main leading to the turbine was returned to the boiler by means of a steam loop.

The steam used was determined by weighing the feed water put into the boiler. The level in the boiler was kept nearly constant during the test, and was made the same at the end as at the beginning.

The blow-off pipe and the auxiliary feed pipe were disconnected and blanked.

All the piping, both steam and feed, was kept tight, and there were no leakages to make allowance for; all the water put into the boiler being used in the turbine and in the calorimeter.



WHEEL AND PINION, DE LAVAL STEAM TURBINE.

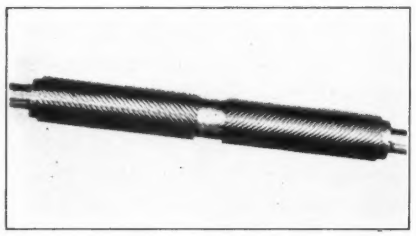
The feed water was weighed in a barrel on a pair of scales sensitive to less than one-quarter of a pound under maximum load. The water weighed was run into a small barrel beneath the scales. The feed pump pumped from this barrel to the boiler. It is probable that the water

weight is correct to less than twenty-five pounds in the total.

The quality of the steam was figured from readings taken on a throttling calorimeter placed near the throttle of the turbine. The time the calorimeter was in use was noted and the amount of steam used by it was calculated by Napier's formula. The orifice used to do the throttling was one-quarter inch in diameter.

Pressures were taken at the throttle and in the case supplying the nozzles.

This latter pressure is beyond the governor, and fluctuates with any change of load. Temperatures of the steam at



PINION, DE LAVAL STEAM TURBINE.

these two places were taken also. It was thought that the throttling by the governor might dry out any slight amount of moisture in the steam, and that the steam entering the nozzles might be slightly superheated. During this test the throttling was slight; and there was but little change in the quality of the steam in passing through the governor valve.

The vacuum was measured by a U-tube filled with mercury. The poorer vacuum obtained near the middle of the test was due to low water in the river.

The electrical output was taken up in a water-cooled resistance. The necessary electrical instruments were inserted for the measurement of the power. The load was very steady throughout the test.

Previous to starting on the test, the turbine had been running forty-five minutes. The turbine ran with but little noise.

Duration of test, nine hours.

Boiler-pressure gauge, 152.9 pounds.

Boiler pressure below governor valve, 145.9 pounds.

Quality of steam, 1.05 per cent priming.

Barometer, 29.90 inches.

Vacuum, 25.47 inches.

Average volts, dynamo No. 1, 262.7.

Average volts, dynamo No. 2, 262.1.

Total amperes, 202.

Average total kilowatt output, 106.1.

Average total electrical-horse-power output, 142.2.

Average total brake-horse-power input, 160.4.

Average number of revolutions per minute, 1,200.

Total steam used for nine hours, 25,661 pounds.

Average steam per hour, 2,851 pounds.

Average steam per hour, corrected for moisture, 2,826 pounds.

Steam per kilowatt-hour, 26.49 pounds.

Steam per electrical-horse-power-hour, 20.05 pounds.

Steam per brake-horse-power-hour, 17.77 pounds.

Steam per brake-horse-power-hour, corrected for moisture, 17.62 pounds.

The electrical instruments were all calibrated before and after the test by Professor F. A. Laws, also of the Boston School of Technology.

Norton Plain Grinding Machines.

The Norton Grinding Company, Worcester, Mass., is manufacturing a number of different types of plain grinding machines. These machines are made with a fixed wheel-base and a moving work table. By this plan are secured convenience and rapidity in production, accurate work, and a small expenditure for power and repairs.

With a moving work table and a fixed

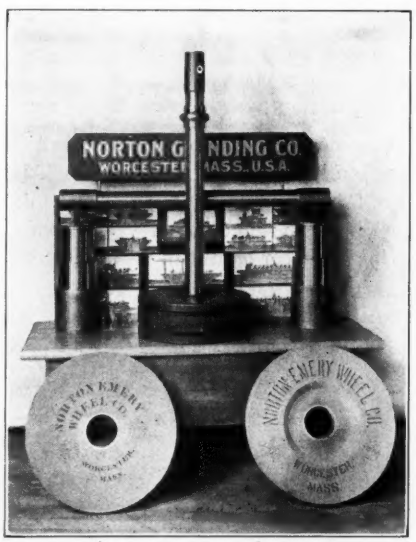


EXHIBIT OF THE NORTON GRINDING COMPANY AT THE RAILWAY MEN'S CONVENTIONS.

wheel-base the table moves past a fixed cutting point, and enables the employment of a simple and rigid cross-fed mechanism. The plan also allows the operator to reach all adjustments and speed changes without moving from one point, regardless of the length of the work.

The machines are provided with convenient means for a wide range of speeds. The devices are simple, and, being an adaptation of the well-known belt and cone, are easily understood by the operators.

The machines are equipped for electric drive, these being the regular machines with motor drive added. This arrangement provides for lifting work in and out with a crane, and for the passage of a crane overhead. The driving mechanism is within easy reach, and is made of the best material in a thorough, workmanlike manner.

At the recent exhibition of railway and kindred appliances at Manhattan Beach, L. I., during the convention of the American Railway Master Mechanics' Association and the Master Car Builders' Association, the Norton Grinding Company made a very interesting exhibit. The accompanying illustration is a reproduction of this exhibit, showing views of the various types of grinding machines and several pieces of work performed by this apparatus.

Ore and Coal-Handling Machinery.

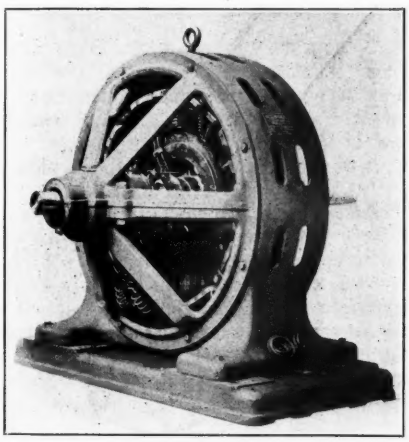
The Wellman-Seaver-Morgan Company, engineer and manufacturer, Cleveland, Ohio, has published a most elaborate and handsome catalogue descriptive of ore and coal-handling machinery. A considerable portion of the work is devoted to illustrations of special electric overhead traveling cranes. In addition to this there are described and illustrated Hulett patent automatic ore-unloaders and unloading and reloading bridges, cranes, etc., car-dumping machinery, locomotive cranes and revolving derricks, excavating buckets, and various other types of machines for different lines of work. Several illustrations are given showing the extensive works of the company at Cleveland and at Akron, Ohio. The New York offices of the Wellman-Seaver-Morgan Company are at 42 Broadway, under the management of Mr. W. A. Stadelman.

"A Paper Proposal" is the title of a clever little love story published by the Lackawanna Railroad solely on its merits as a bright piece of fiction. It is contained in a beautifully illustrated book of 128 pages, which describes some of the attractive vacation places along the lines of this road. This book may be had by sending ten cents in stamps to T. W. Lee, general passenger agent, New York city.

Belted Type, Rotating Field Alternators.

A line of belted type, self-contained, rotating field, alternating-current generators, such as shown in the illustrations, has recently been placed on the market by the Westinghouse Electric and Manufacturing Company. The machines are built for single, two and three-phase circuits, in sizes from 30 to 200 kilowatts. The single-phase generators are manufactured for 220, 440, 1,100 and 2,200-volt circuits, at 7,200 alternations, and besides these the polyphase machines are wound for 6,600 volts and both 3,000 and 7,200 alternations. In this type of generator the armature is stationary, a construction which facilitates the insulation of its windings, and provides that the field current instead of the armature current pass through the brushes and collector rings.

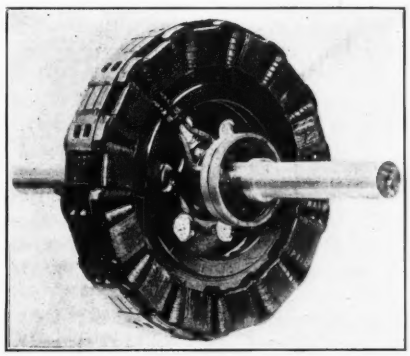
The frame of the stationary armature is cast in one piece with slots machined



BELTED TYPE, ROTATING FIELD ALTERNATOR.

on the inside for holding the punchings which receive the windings. These are composed of wire, strap or bars, depending on the size and voltage of the generator. Open slots are employed in machines up to seventy-five kilowatts, with coils held in place by hard fibre wedges. In the larger machines partially closed slots are used. Horizontally split brackets which carry the bearings are bolted to this cast-iron frame. The bearings are generous in their dimensions, and are self-oiling, having oil rings and an oil gauge on each, thus giving superior running qualities. All generators have bed-plates with large foundation areas and suitable belt tighteners.

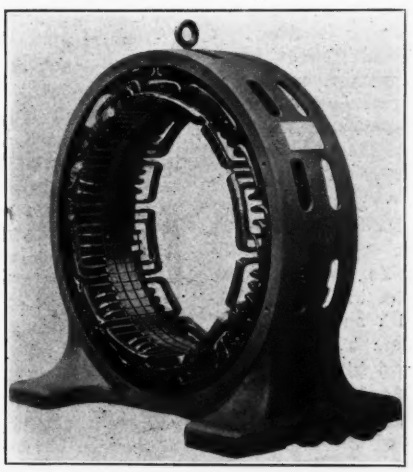
The poles of the smaller generators are of cast steel with pole caps of the same material. The poles of larger sizes are laminated and keyed or dovetailed to a cast-iron spider. The field coils are composed of square wire so wound as to expose the maximum surface. In the generators having laminated poles heavy brass wedges, which hold the field coils in place, retard any shifting of the field between the poles, and thus practically eliminate pumping between the generator and any rotary converters or synchronous motors



ROTATING FIELD.

which may be connected in the system and ensure satisfactory parallel operation of two or more generators. A large shaft ensures cool running of the bearings, and the absence of any distortion which might result from the pull of the belt.

Every means has been utilized for the rapid dissipation of heat from all parts of the machines. Open spaces in the laminated field register with those in the armature, and during operation air is drawn in through the field spider and forced out through the stationary core and windings, thus ensuring low operating temperature.



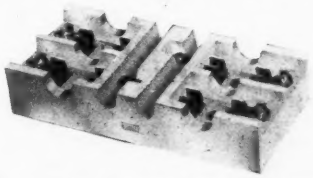
STATIONARY ARMATURE, BELTED TYPE, ROTATING-FIELD ALTERNATOR.

The single-phase generators have compensating field windings supplied with rectified alternating current. A commutator on the shaft adjacent to the collector rings has its brushes connected to the secondary of a series transformer in the armature circuit and its segments to the self-exciting field coils. The compensating winding is so designed that the generator can be adjusted for a practically constant voltage from no load to full load or for an increase in voltage.

The performance of these machines shows a high degree of excellence in efficiency. The proportions of the machines are those which both theory and practice have demonstrated to be the best.

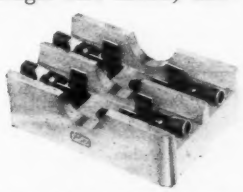
"Peru" Cartridge Fuse Blocks.

Illustrated herewith is a new line of National Code standard cartridge fuse blocks just placed on the market by the Peru Electric Manufacturing Company,



TWO-WIRE, DOUBLE BRANCH BLOCK.

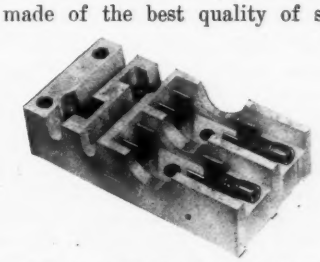
of Peru, Ind. These blocks have all terminals completely protected by porcelain. This line consists of 250-volt 0-30 and 31-60-ampere mains, branches and crossover, and 600-volt 0-30 and 31-60-ampere single-wire mains, and will take



TWO-WIRE FUSE BLOCK.

any National Code fuses of corresponding capacity.

"Peru" blocks combine neat appearance and solid construction. Heavy brass is used on the connections, and the clips are made of the best quality of spring



TWO-WIRE, SINGLE BRANCH BLOCK.

bronze. A perfect contact with the fuse is obtained.

The terminals are countersunk in the porcelain, making it impossible for the clips to come out of line, and the porcelain walls between the terminals are sufficiently high to prevent a short-circuit when a conductor is placed across the block. On the 0-30-ampere cutouts the terminals are set back from the end of the block, giving additional protection.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

LARGE POWER PLANT TO BE ERECTED AT READING, PA.—The Union Traction Company, Reading, Pa., has decided to begin the erection of a large power plant at the mouth of the Tulpehocken river. The plant will furnish current for lighting the city and also for operating the city and suburban traction lines. The plant will generate about 10,000 horse-power.

REORGANIZATION OF THE NEW ORLEANS RAILWAYS COMPANY—A reorganization of the New Orleans Railways Company is about to be effected. A new company will be organized under the laws of Louisiana, known as the New Orleans Railway and Light Company. The new concern will have a capital of $20,000,000 common stock, and $10,000,000 preferred.

MORTGAGE OF THE WASHINGTON, BALTIMORE & ANNAPOLIS RAILWAY COMPANY—A deed of trust to secure the issue of $1,000,000 second mortgage bonds has been placed on record by the Washington, Baltimore & Annapolis Railway Company. The bonds will mature May 1, 1930, and bear interest at the rate of five per cent per annum, payable semi-annually. All the rights and property of the railway company are pledged to the Cleveland Trust Company, of Cleveland, Ohio.

ELECTRICAL NOTES FROM MEXICO—Mr. Teodoro Garduno will build a hydroelectric power-plant on his property near Tacambaro, Michoacan. The plant will have a capacity of 220 horse-power, and supply electric light to the city of Tacambaro. A Canadian syndicate has secured control of the two street car lines of Monterey, and will commence the electrification of them immediately. It will also build a new line under the concession recently purchased from Messrs, Mackin and Dillon, of Monterey. The price paid for the properties, including the concession, is about $825,000. Henry R. Harvey has applied for a concession to develop a water power situated in the Temosachic municipality, state of Chihuahua. Ten thousand litres of water per second pass over the fall which is on the Aros river.

MERGER OF RAILWAY AND POWER COMPANIES IN SOUTH CAROLINA—The Columbia Electric Street Railway, Light and Power Company, and the Columbia Water Power Company, Charleston, S. C., have been finally merged. The name of the new company is the Columbia Electric Street Railway and Power Company. A new mortgage will be executed to secure the issue of bonds, which will cover the purchase of the water-power company, and which will also leave a considerable fund for the permanent improvements contemplated. The complete board of directors has not yet been elected, but the following men will direct the affairs of the company for the present: E. W. Robertson, Henry Parsons, L. W. Parker, A. E. Gonzales and William Elliott, Jr.

SALE OF TRACTION SYSTEMS IN PENNSYLVANIA—The property of the Philadelphia & Lehigh Traction Company was disposed of under foreclosure sale at Allentown, Pa., recently. The court imposed the conditions that the upset price would be $1,000,000, ten per cent of purchase price down, with an entry fee of $25,000. The property was bought by William T. Harrity, on behalf of George H. Frazier, H. C. Trexler and himself, for $1,000,000. Mr. Harrity stated that about $1,800,000 would be expended to bring the property up to the most modern standard, and that it was proposed to eventually run cars from Allentown to Philadelphia. Among the improvements contemplated are a new power-house and a new bridge at South Allentown. It is stated that the purchasers represented the bondholders of the company.

SALE OF NEW YORK & LONG ISLAND TRACTION COMPANY—The Interborough Rapid Transit Company and the Long Island Railroad Company have jointly taken over the New York & Long Island Traction Company. The consideration involved is not given, although it is stated that the two companies paid equal shares of the purchase money, and that each company will have four representatives on the board of directors of the reorganized concern. The new president of the company will be Arthur Turnbull. F. L. Fuller will be general manager; Frank E. Haff, secretary, and Jordan I. Rollins, treasurer. The directors of the company are August Belmont, Ralph Peters, E. P. Bryan, David C. Green, General James Jordan, A. L. Langdon, Alfred Skitt, C. L. Addison and Arthur Turnbull. The lines of the New York & Long Island Traction Company will be used as feeders to the Pennsylvania Railroad system, which is being extended to Long Island.

REORGANIZATION OF THE EASTERN OHIO TRACTION COMPANY—A plan has been submitted to the stockholders of the Eastern Ohio Traction Company, Cleveland, Ohio, for the reorganization of that company. The new company is to be known as the Cleveland & Mahoning Valley Traction Company, with a capital stock of $3,000,000. Of this, $1,000,000 will be five per cent preferred, and $2,000,000 common. In order to meet the floating indebtedness of $878,000 it is proposed to sell $113,000 par value of Cleveland & Eastern bonds, to which will be added as a bonus ten per cent of the preferred; and also to sell $850,000 of the first mortgage consolidated bonds at ninety, with which will be given par of the common stock and fifteen per cent of the preferred stock. These securities are to be sold to the stockholders at the rate of $38.87 for each share of the stock of the company which they hold at the present time. A connection is to be made with the Mahoning Valley Traction Company, which will give an entrance into Youngstown; and the Cleveland & Eastern division is also to be connected with the Garretsville line.

NEW FAST ELECTRIC LINE PROPOSED FROM NEW YORK TO NEWARK—Mr. Thomas N. McCarter, president of the Public Service Corporation, of New Jersey, has given out a statement showing that a high-speed electric road is proposed from Newark to New York city. The road is to be constructed and operated by a subsidiary corporation soon to be organized. The line will have no grade crossings within the city limits of Newark. It will be carried underneath the Passaic river in a tunnel, and probably over the Hackensack river by a bridge. In Jersey City the road will be partly elevated and partly below grade. The company will erect a terminal station in Newark and an office building, ground for which has already been purchased. A plan proposed last winter involved the abandonment of the Morris canal, and the use of the canal bed for the road. President McCarter states that the plan outlined above provides a more direct and better entrance into Newark than would have been possible by building a road on the canal bed. The entire route has been surveyed and laid out, and much of the proposed right of way has been secured.

RAPID TRANSIT BOARD INTERVENES IN ALDERMEN'S INJUNCTION SUIT—The board of rapid transit railroad commissioners of New York, by permission of the Supreme Court, intervened in the taxpayers' suit against Mayor George B. McClellan and others. This is a suit which is understood to have been brought by the board of aldermen to test the constitutionality of the recent legislation depriving the board of aldermen of its power over franchises. The court permitted counsel for the rapid transit commission to submit a brief enlightening the court as to facts involved in the suit. The brief states: "Not only will the interests of the city be injuriously affected by the granting of an injunction in this case, but the interests of the plaintiff in no respect advanced. The board assumes that the plaintiff's theory is that it is contrary to his interests as a taxpayer, and to the interest of the city, that any roads should be built until the constitutionality of the act in question has been determined; but even if an injunction should be denied at the present time; there is not the slightest practical risk that any final step can be taken toward the building of a road until ample time has elapsed for a hearing before the Appellate Court. The act which is in question in this connection is either constitutional or unconstitutional. If it is constitutional, then the board of estimate and apportionment ought not to be enjoined from dealing with the routes now before them. Such delay would be a real and very serious injury to the interests of all the people of the city." The court has refused to grant the injunction asked for in the suit, holding that the public interests would be injured by even a temporary injunction, and that the legislature has the power to vest the control of franchises in a city in any local body it sees fit.

PERSONAL MENTION.

MR. W. O. SETTLE has resigned his position as manager of the Water and Light Company at Lamar, Mo., to accept a similar position at Murphysboro, Ill.

MR. GEORGE ALFRED DAMON, managing engineer of the Arnold Company, Chicago, Ill., is now one of the happiest men in that city. This is not because of the eminence of his position, but is occasioned by the arrival on Saturday morning, June 17, of George Alfred, Jr.

MR. C. P. WAINMAN, general manager of the Northwestern telephone exchange at Minneapolis, has been elected vice-president of the company. He has also been appointed vice-president of the Duluth Telephone Company and the Mesaba Telephone Company. Mr. Wainman has been connected with the Northwestern company since 1878. He was formerly manager of the Cleveland exchange, and was transferred to Minneapolis in 1887.

MR. ARCHIBALD B. ROBINSON, Pittsfield, Mass., has been elected general manager of the Woronoco Street Railway Company, of Westfield, Mass. He will succeed Mr. James H. Bryan, who has been president and general manager of the road for several years. Mr. Robinson has been connected with the Berkshire Street Railroad, in Pittsfield, since its organization in 1901. He organized the staff and office work of the company, and directed all the details of the management.

MR. GEORGE R. WADSWORTH has resigned his position as resident engineer of the New York Central & Hudson River Railroad, to accept a position on the staff of J. G. White & Company, as assistant to the construction superintendent. Mr. Wadsworth was graduated in 1898 from the Massachusetts Institute of Technology in civil engineering. Since graduation he has been continuously employed on the New York Central Railroad, first being assigned to the office of division engineer at Albany, after which he worked in various capacities, ultimately being appointed assistant engineer. After having performed several classes of work, Mr. Wadsworth was appointed resident engineer of the Hudson district, in charge of the contract work from Mott Haven to Croton.

MR. EUGENE LENTILHON, C.E., for the past several years a contracting engineer in New York city, has become associated with J. G. White & Company, and is now on his way to Chili on a mission covering the investigation of a number of important engineering projects. Mr. Lentilhon is a graduate of the Sheffield Scientific School of Yale University. For several years after his graduation he was in the service of the drydock department in New York city. His most important work in this direction was his supervison, as assistant engineer, of improvements and repairs on the North river from the Battery to Fourteenth street. In 1897 Mr. Lentilhon resigned from the dock department to become a contracting engineer. Among the principal contracts completed by him were the construction of Hudson Park, New York city; the erection of two buildings for the New York navy yard, the removal of the reservoir from the site of Fifth avenue between Fortieth and Forty-second streets, New York city, and the building of the foundations for the New York public library.

MR. ALEXANDER JAY WURTS, Ph. B., M. E., E. E., has been appointed professor of applied electricity and head of the department of electricity in the Carnegie Technical School at Pittsburg. He will assist in the preparation of a curriculum and the equipping of the electrical laboratory in the School of Applied Science. Professor Wurts was born at Carbondale, Pa., in 1862, and was educated in the schools of New Haven, Ct. He was graduated from Yale University with the degree of Ph. B. in 1883. He received the degree of M. E. from Stevens Institute of Technology in 1884, after completing a post-graduate course. Following this he studied electrical engineering abroad. He has been connected with the United States Electric Lighting Company, of Newark, N. J., and the Julian Storage Battery Company, of Camden, N. J. In 1887 he went with the Westinghouse Electric and Manufacturing Company for scientific research, laboratory and development work. It was while holding this position that he invented the lightning arrester bearing his name, and devised many appliances of a protective nature. He received the John Scott Medal from the city of Philadelphia, under recommendations from the Franklin Institute, for his discovery of non-arcing metals. In 1898 he started the development of the Nernst lamp in this country, and carried it to a high state of efficiency. In 1904 he resigned from the Nernst Lamp Company and returned to the Westinghouse Electric and Manufacturing Company, to carry on special development work. It was about this time that he became associated with the Carnegie Technical Schools as one of the office staff.

ELECTRICAL SECURITIES.

During last week there was a pronounced improvement in the tone of the stock market, fairly good advances being recorded in many prominent securities. A wave of confidence seems to have permeated financial quarters despite threatening signs of further international complications between European powers. While the initiative in the speculative activity was taken by professional manipulators there was a substantial public interest and a goodly amount of commission house business back of the rally. The real reason for the steady recovery and advance seems to lie in the fact that notwithstanding the severe trying-out period which the market has undergone the features of stability are so pronounced as to dispel any anxiety with regard to a financial or speculative calamity. Fundamental conditions are sound and promising. With railroad earnings continuing favorable and indications that even through the summer there will be busy times in almost every industry, it now looks as if the fall would bring about a very solid business condition, upon which will be reared even greater institutions than have yet been projected.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JUNE 24.

New York:	*Closing.*
Brooklyn Rapid Transit	67¾
Consolidated Gas	192¼
General Electric	174¾
Interborough Rapid Transit	202
Kings County Electric	200
Manhattan Elevated	164½
Metropolitan Street Railway	124¼
New York & New Jersey Telephone	165
Westinghouse Manufacturing Company	180

Directors of the Westinghouse Electric and Manufacturing Company have declared the regular quarterly dividend of 2½ per cent on the preferred and assenting and non-assenting stocks, payable July 10.

Boston:	*Closing.*
American Telephone and Telegraph	142
Edison Electric Illuminating	240
Massachusetts Electric	62½
New England Telephone	139
Western Telephone and Telegraph preferred	100

The instrument output of the American Telephone and Telegraph Company for the month of May is as follows: gross output, 168,764; returned, 53,212, leaving net of 115,552, as compared with 52,176 for 1904. Since December 31 the net output has been 545,950, as against 305,326 for 1904. The total number of instruments now outstanding is 5,026,514. Coupons from the 4 per cent collateral trust bonds of the company, payable by their terms on July 1, 1905, at the office of the treasurer in New York, will be paid by the Manhattan Trust Company, 20 Wall street.

Philadelphia:	*Closing.*
Electric Company of America	11⅛
Electric Storage Battery common	78
Electric Storage Battery preferred	78
Philadelphia Electric	8⅝
Philadelphia Rapid Transit	27½
United Gas Improvement	95

Electric Storage Battery directors have declared the regular quarterly dividends of 1¼ per cent on both the common and preferred stocks, payable July 1.

Chicago:	*Closing.*
Chicago Telephone	138
Chicago Edison Light	158
Metropolitan Elevated preferred	66
National Carbon common	66
National Carbon preferred	117
Union Traction common	7
Union Traction preferred	33

National Carbon directors have declared the regular semi-annual dividend of 1½ per cent on the common stock, payable July 15 to stockholders of record July 5. Books close July 5 and reopen July 17.

OBITUARY NOTICES.

DEATH OF CHARLES H. WELLMAN AND THOMAS R. MORGAN.

MR. CHARLES H. WELLMAN AND MR. THOMAS R. MORGAN were killed in the wreck of the Twentieth Century Limited at Mentor, Ohio, on June 21. Both gentlemen were officers of the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, Mr. Wellman being general manager, and Mr. Morgan, vice-president and works manager. Charles H. Wellman was born in Nashua, N. H., on June 12, 1863. His father was then superintendent of the Nashua Iron Company. In 1884 Mr. Wellman became connected with the Morgan Engineering Company at Alliance, Ohio. In 1885 he took the position of chief draughtsman of the Otis Steel Company, Cleveland, Ohio. Soon afterward he was promoted to head of the open hearth department. In 1890 he became superintendent of the Wellman Steel Company at Thurlow, Pa., and in 1895 superintendent of the Illinois Steel Company at South Chicago, Ill. Upon the formation of the Wellman-Seaver-Morgan Company he became its general manager and engineer. Mr. Wellman is survived by a wife and three children. His home was on Lake avenue, Cleveland.

Thomas R. Morgan was born in South Wales in 1859, but came to this country at the age of six months. His father, after reorganizing the Pittsburg Alliance Steam Hammer Works, removed to Ohio and founded the Morgan Engineering Company, and Mr. Morgan commenced work with the latter concern on his graduation from Mount Union College. At the age of twenty-one he was works manager. When he was twenty-five he became secretary and general manager of the company. He became associated in 1897 with the Wellman-Seaver Company, and when the Wellman-Seaver-Morgan Company was formed he became its second vice-president and works manager. Mr. Morgan is survived by a wife and three children.

MR. THOMAS C. WALES, chief engineer of the New England Telephone Company, died in Boston, Mass., at 11 A. M., Tuesday, June 27. He was taken ill with appendicitis at Burlington, Vt., and was brought on a special train to Boston, but did not survive the operation. Mr. Wales was thirty-four years of age, and was graduated from the Massachusetts Institute of Technology in 1892 in the department of electrical engineering. He married the daughter of R. H. White, the great drygoods merchant, of Boston. He is survived by Mrs. Wales and three children. Mr. Wales had a beautiful home on Chestnut Hill, one of the suburbs of Boston. He was a man of splendid character, esteemed among his associates, and was working out a career of great usefulness in his chosen profession.

NEW INCORPORATIONS.

COLUMBUS, OHIO—Prospect Electric Light and Power Company, Prospect. Increased to $20,000.

SPRINGFIELD, ILL.—Pana Gas and Electric Company. Increased from $1,000 to $150,000.

INDIANAPOLIS, IND.—International Light and Water Company; $50,000. International Telephone Company; $50,000.

DES MOINES, IOWA—Milo & Sandyville Telephone Company, Sandyville. $1,000. Incorporators: J. M. Kirkpatrick and others.

AUSTIN, TEX.—The People's Telephone Company, of Tehuacuna. $2,500. Incorporators: J. Peeples, J. Desenberry and A. J. Collins.

ABERDEEN, MISS.—Mississippi & Alabama Telephone Company. $10,000. Incorporators: J. C. Cheek, J. C. Burline, W. G. Davis and others.

ALBANY, N. Y.—The Oatka Power and Transmission Company. $50,000. Directors: Carl H. Guess, John F. Reno and Porteous Cunningham.

GUTHRIE, OKLA.—The Snyder Telephone Company. $5,000. Stockholders: S. Cormack, Otis Stofer, Fred Swartzen, J. V. McClintic and A. J. Helena.

ANDOVER, N. Y.—Andover Electric Power and Light Company. $10,000. Incorporators: R. A. Stout, A. B. Richardson and J. H. Backus, all of Andover.

ALBANY, N. Y.—Orange County Power Company. $50,000. Incorporators: William W. Haney, Louis B. Marks, both of New York; Henry Floy, East Orange, N. J.

SPRINGFIELD, OHIO—New Carlisle Telephone Company, of New Carlisle. $25,000. Incorporators: C. D. Sheldon, E. C. Miller, E. A. Reed, T. P. Sylvan and R. B. Hoover.

ELECTRIC RAILWAYS.

LOS ANGELES, CAL.—The board of county commissioners has sold to J. Harvey McCarthy, president of the Pioneer Investment and Trust Company, a forty-year franchise for a street car line on Indiana avenue.

LOGANSPORT, IND.—Work has been begun on the construction of the Fort Wayne & Wabash Valley Traction Company's extension from Lafayette to Logansport, connecting the former city with Fort Wayne and Indianapolis.

CHATTANOOGA, TENN.—In addition to the construction of the interurban electric railway through Chickamauga Park and Fort Oglethorpe to Ducktown, S. W. Divine will immediately secure the right of way along the route of the old broad-gauge road and construct an electric line up Lookout mountain.

LIMA, OHIO—The Lima, Findlay & Toledo Electric Railway, which is building a trolley road in the interest of the Western Ohio Railway from Lima to Findlay, Ohio, has made a mortgage to the Citizens' Saving and Trust Company, Cleveland, trustee, to secure $600,000 first mortgage sinking fund five per cent gold bonds.

NASHVILLE, TENN.—At a meeting of the stockholders of the Nashville, Crocker Springs & Ridge Top Electric Railway the following board of directors was elected: W. C. Dibrell, J. H. Bruce, W. K. Phillips, Watkins Crockett, W. J. Cummins, W. P. Ready, H. G. Hull and George S. Parkes. Immediately upon the adjournment of the stockholders' meeting the board of directors met and elected the following officers: W. P. Ready, president and general manager; W. J. Cummins, vice-president; H. G. Hill, secretary, and Watkins Crockett, treasurer.

CHARLESTOWN, W. VA.—The Winchester & Washington City Railway Company has purchased from the estate of ex-Governor Lowndes, of Maryland, and David Sloan, of Lonaconing, Md., their water power on the Shenandoah river, four miles southeast of Charlestown, for $10,000. The company has an engineer on the premises who is making surveys, and the power will be developed at once. It is stated upon reliable authority the company will build a trolley line from Harper's Ferry to Winchester by the way of Charlestown and Berryville. A line is also to be built from Berryville to Bluemont, Va., and probably from that point to Washington, D. C. The power is said to be capable of developing 2,000 horse-power. Winchester, Berryville, and Philadelphia parties are the promoters.

SOUTH BEND, IND.—The South Bend Western Railroad Company has closed a contract with George Townsend, an Indianapolis railroad builder, for the construction of an electric line from South Bend to Laporte, Ind., about thirty miles west. Construction will begin as soon as material can be placed on the ground, and cars will be running within six months. The same stockholders have arranged to take over an electric line now operating between Laporte and Michigan City, Ind., eight miles, as soon as the South Bend-Laporte line is in operation. The Indianapolis, Logansport & South Bend Traction Railroad Company is preparing for the construction of a line from South Bend to Logansport, Ind., through Rochester, Bremen, Argos and Bourbon, Ind. Right of way valued at many thousands has been secured, and several townships have voted subsidies.

ROCKVILLE, CT.—The $150,000 five per cent twenty-year bonds of the Rockville, Broad Brook & East Windsor Street Railway Company have been sold. The $100,000 of six per cent preferred stock of the Hartford & Springfield Street Railway Company, which is issued in place of the capital stock of the new company, will be owned and held in the treasury of the Hartford & Springfield company. The earnings from the operation of the new road will be received by the Hartford & Springfield company, after paying the fixed charges, and it is anticipated that it will leave a good profit after paying dividends on bonds and stock. The expenditure in the building of the road includes the installation of an additional 600-horse-power cross-compound engine and generator in the present power station at Warehouse Point. It is claimed that the new road will have a population of 22,000 people to draw from, and in addition will induce a considerable amount of new business from Rockville, Warehouse Point and Windsor Locks north to Springfield, Holyoke and the upper Connecticut valley.

TELEPHONE AND TELEGRAPH.

TRENTON, MO.—The Trenton Telephone Company has made arrangements to rewire the Laredo system.

TOWLESVILLE, N. Y.—The Bielefeld telephone line from Golf Hollow to Towlesville has been completed.

PHILADELPHIA, PA.—The Keystone Telephone Company has sold $4,000,000 first mortgage five per cent bonds to a New York syndicate.

JACKSONVILLE, FLA.—The Eustus Telephone Company has extended its line to Grand Island, and will in the near future extend its line to Mount Dora.

PLAINFIELD, N. J.—Fifty incandescent lights will be installed at Lincoln immediately by the Public Service Corporation. The price to be paid is $900 per year.

PULTENEY, N. Y.—The Overland Telephone Company is making extensive improvements in and around Pulteney. A new toll line will be built to Hammondsport.

NEWARK, N. J.—A local telephone line with long-distance connections is being built at Glen Gardner Junction and New Hampshire. The central office will be located at Glen Gardner.

WEST STOCKBRIDGE, MASS.—At the annual meeting of the Mutual Telephone Company C. W. Sprague was elected president and general manager, and J. S. Moore, secretary and treasurer.

ASBURY PARK, N. J.—To improve the telephone service in Asbury Park as well as its long-distance service, the New York & New Jersey Telephone Company is installing a $50,000 trunk line by way of South Amboy, Keyport, Leadville, Tinton Falls and Asbury avenue.

UTICA, N. Y.—A force of fifty men, under the direction of Engineer Edward Cline, of the Utica Home Telephone Company, has begun work of constructing the new independent telephone lines at Oneonta. It will probably be completed in about ninety days.

VALLEJO, CAL.—The Sunset Telephone Company is to practically rebuild its system in Vallejo at a cost of about $18,000. This has been rendered necessary by the constantly increasing business in Vallejo and the demand for better service. Four-party lines are to be installed instead of the ten-party lines now in use and other necessary improvements are to be made. Material for the work has already been ordered.

MORGANTOWN, W. VA.—At a recent meeting of the stockholders of the People's Telephone Company the following board of directors was elected for the ensuing year: Milton Hirschman, L. S. Brock, George C. Baker, E. M. Grant, J. P. Fitch, Frank Cox, W. E. Glasscock, D. H. Courtney and I. C. White. Later the board met and organized and elected the following officers: president and treasurer, Milton Hirschman; secretary, George C. Baker.

SAN DIEGO, CAL.—The Home Telephone Company has been granted a franchise to string wires and erect poles on any public highway in the county. The franchise was secured by the company for the express purpose of extending its lines from La Jolla northward, the intention being to ultimately connect with the long-distance lines being extended southward from Santa Ana, thereby giving direct connection with Los Angeles and other northern cities.

MIDDLETOWN, N. Y.—The Citizens' Stamford Telephone Company, which has offices at Pine Hill, Delaware County, has given a mortgage of $200,000 upon its franchises and property to the Knickerbocker Trust Company, of New York city, to secure the payment of bonds, which are to be issued by that company to improve and extend its lines. The bonds are to be payable in 1935, and will be five per cent gold bonds. One hundred bonds will be of $500 each and 150 at $1,000 each. This will be one of the best lines in Delaware County when completed.

MILWAUKEE, WIS.—Judge Halsey has appointed John E. Reilly receiver of the Independent Consolidated Telephone Company, under a bond of $30,000. The appointment was made at the instance of J. P. Weirich, who commenced suit against the company several weeks ago. The Independent Consolidated company is the largest independent telephone concern in the state, having 700 miles of wire and over 1,200 subscribers in Sauk, Richland, Iowa and Grant counties. It is expected that the business will be continued under the receiver. The corporation recently increased its capital stock from $100,000 to $200,000, and issued $70,000 in bonds.

ELECTRIC LIGHTING.

CUMBERLAND, R. I.—The town of Cumberland has voted, 153 to 79, not to establish a municipal electric lighting plant.

MURFREESBORO, TENN.—The city has made a ten years' contract with the City Gas and Electric Company to supply street lights.

WASHINGTON, IOWA—The Washington Illuminating Company has sold its plant to George Carson, of Iowa City. The price paid was $36,500.

FORT SMITH, ARK.—Bonds have been sold to the amount of $17,000 for the purpose of installing a municipal electric light plant in Dardanelle.

GAINESVILLE, TEXAS—The Gainesville Light and Fuel Company has sold its plant to J. A. Jones, of California, and E. E. Hull, of Oklahama. The new owners will spend $25,000 in rebuilding the plant.

CAMPBELLSVILLE, KY.—The Campbellsville Electric Light Company has been organized to put into operation an electric light plant. President, J. L. Atkinson; secretary and treasurer, J. R. Davis; superintendent and general manager, B. S. Kincart.

NORTH TONAWANDA, N. Y.—The board of aldermen has decided to reject the bid of the Tonawanda Power Company for furnishing electric light for the city and will readvertise for bids that will permit gas as well as electric companies to submit bids.

NEWARK, N. Y.—The Newark New Light, Heat and Power Company has sold its plant and fixtures to a Philadelphia syndicate composed of E. C. Manderville, L. J. Rigby, W. L. Matthew, W. W. Levering and H. J. MaKriver. The price paid was $75,000.

ROGERS, ARK.—The Rogers waterworks system and the electric light system have been consolidated. The new company will be known as the Rogers Water and Light Company. The capital is $100,000. The following are the officers: president, W. R. Felker; vice-president, F. F. Freeman; secretary and treasurer, J. E. Felker.

NIAGARA FALLS, N. Y.—At the annual meeting of the Niagara Falls Hydraulic Power and Manufacturing Company the following officers were elected: president, George B. Matthews, Buffalo; vice-president, W. D. Olmsted, Buffalo; secretary and treasurer. Arthur Schoellkopf, Niagara Falls. The officers as named, with the following will constitute the board of directors: Jacob S. Schoellkopf and J. L. Romer, of Buffalo.

LA FOLLETTE, TENN.—The La Follette Water, Light and Telephone Company has been incorporated under the laws of West Virginia with a paid-up capital of $150,000. The company will furnish light, water and telephone service to La Follette, the city having contracted for fifty arc lamps, and forty fire hydrants. The company will install a three-phase generating plant, and a telephone exchange which will start with 300 subscribers. The officers of the company are: president W. C. Knight, St. Louis; secretary-treasurer, F. H. Joss, Minneapolis. The other directors are T. C. Whalen, W. A. Owens and G. A. La Follette.

NEW MANUFACTURING COMPANIES.

NEW YORK, N. Y.—The Hellmund Collbohm Electric Company has been incorporated by Grant B. Rossman, New York; Alfred Wenzel, Jersey City, and Max H. Collbohm, New York. The company has a capital of $10,000.

WATERTOWN, N. Y.—The W. E. Kenney Company has been incorporated with the secretary of state to deal in electrical apparatus. The capital stock is $10,000, and the directors are A. F. Lansing, W. E. Kenney and F. M. Boyer.

ROME, N. Y.—The Wire and Telephone Company of America has been incorporated with a capital of $600,000. Charles F. N. Niles, Toledo, Ohio; J. S. Dyett, Rome, and Walter C. White, Cleveland, Ohio, are the directors of the company.

NEW YORK, N. Y.—The Charles A. Thompson Company has been incorporated to manufacture electrical machinery. The company has a capital of $25,000, and the incorporators are Charles A. Thompson, James Shaw, of Brooklyn, and Rudolph Miehling, of New York.

INDUSTRIAL ITEMS.

THE SUMPTER TELEPHONE MANUFACTURING COMPANY has issued bulletin No. 38, describing the Mason multi-discharge lightning arrester.

THE PARKER BOILER COMPANY, Philadelphia, Pa., has issued a booklet, showing the Parker boiler and illustrating some installations made by it of this type of boiler.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., in bulletin No. 95 describes the installation of chloride accumulators for the Carnegie Steel Company at Youngstown, Ohio.

W. R. OSTRANDER & COMPANY, 22 Dey street, New York, is distributing a catalogue of electric fans made by it. About fifteen different types are shown, including both desk and ceiling fans.

THE REPLOGLE GOVERNOR WORKS, Akron, Ohio, is distributing a catalogue, describing new mechanical relay governors. Five types are illustrated, and a table of dimensions of the governors is included.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, is calling attention to the crushers built by it. These include Jeffrey swing-hammer pulverizers, Jeffrey swing-hammer crushers, and a number of different types of roll crushes.

THE IRON CITY ENGINEERING COMPANY, Pittsburg, Pa., has secured from the architects, D. H. Burnham & Company, the contract for the complete electrical installation for the nineteen-story annex to the Frick Building, now in course of construction. This company also has similar contracts for the twelve-story office building for Colonel Henry Schmulbach, Wheeling, W. Va.; the Home of the Good Shepherd, Pittsburg, Pa., and the Baltimore & Ohio passenger station at Youngstown, Ohio.

THE LAIDLAW-DUNN-GORDON COMPANY, 114 Liberty street, New York city, is distributing a 175-page book, describing and illustrating a complete line of steam, electric, gas and power-driven air and gas compressors of all types. The book contains a quantity of valuable information. It gives the results of investigations on air-valve gears, explains the action of the air lift, and gives the amount of air required for pumps and drills. In addition a large amount of data regarding compressed air are given.

THE SUNBEAM INCANDESCENT LAMP COMPANY, Chicago, Ill., has just issued a new bulletin describing and exploiting its complete line of "Sunbeam" reflector lamps. These lamps are furnished in six, twenty-eight and thirty-six candle-powers in all voltages. This bulletin is ready for distribution and a copy will be sent to any one interested upon request either to the above company or to the Western Electric Company. The latter company and its branch houses carry a large stock of "Sunbeam" lamps embracing the entire line.

THE ANSONIA BRASS AND COPPER COMPANY, 99 John street, New York city, has issued a pamphlet descriptive of "Tobin" bronze. A large amount of valuable information is included in this publication. The tensile strength, specific gravity, weight, acid test, crushing strength and torsional strength are given, together with a series of tables of the weights of sheets and rods. Results of a number of tensile tests are given, as well as tests made by the United States government of the "Tobin" bronze used in some of the revenue cutters. A large portion of the book is taken up by testimonials.

THE AMERICAN AIR-COMPRESSOR WORKS, 26 Cortlandt street, New York city, has just published a sixteen-page bulletin, six by nine inches, illustrating and describing a few of its new types of air-compressors. Copies of this bulletin will be sent gratis upon application. High-duty vacuum pumps are made in many sizes, both steam and power driven, and full particulars, prices, etc., will be mailed upon request. Small belt machines are built, suitable for operating a few air hoists, pneumatic stone tools, etc., or for experimental, laboratory or vacuum purposes, especially where the requirements are small.

DODGE & DAY, engineers and architects, Philadelphia, Pa., made a preliminary examination a short time since of the plant of the Link-Belt Machinery Company, Chicago, Ill. As a result they have been further commissioned to make a thorough examination of the mechanical and electrical features with a view of making a layout that will accomplish in the most economical and efficient manner the scheme of changes and improvements contemplated by the management. It is probable the power plant will be enlarged, and considerable additional electrical equipment installed, as well as some new machine tools.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., is distributing circular No. 1104, describing Westinghouse portable instruments. These include voltmeters for direct and alternating currents, milliammeters for direct and alternating currents, lamp tester's volt-wattmeter for direct and alternating currents, ammeters for alternating currents, single-phase wattmeter for alternating currents, polyphase wattmeter for alternating currents, power-factor meter for two and three-phase currents, and a line of transformers. The company is also distributing circular No. 1102, describing the Westinghouse direct-current multiple arc lamp for 110 and 220 volts.

THE F. BISSELL COMPANY, 226-230 Huron street, Toledo, Ohio, has issued a catalogue which it states will enable a purchaser "to obtain quotations on the spot." Beginning with a single slab big enough to hold a voltmeter, a switch, a rheostat and ground detector, the catalogue goes by degrees through the whole line of single-phase panels and multiple panels, and each combination has its price. There are additions and deductions for parts added and omitted, and any person interested can easily compute the price of any given combination. The book is now ready for all who desire it. The company is also issuing a booklet entitled "The Machine Tool and the Motor," which describes the application of the "Northern" variable-speed motor to various types of machine tools. The F. Bissell Company had a number of appliances on exhibition at the Independent telephone convention at Chicago. Among these were novelty potheads and sleeves, security specialties for telephone construction, and other apparatus.

THE WESTINGHOUSE MACHINE COMPANY, East Pittsburg, Pa., has received a number of orders from Japan for steam and gas engines. During the years 1903 and 1904 Takata & Company, agents for the Westinghouse Machine Company in Japan, sold fifty-six Westinghouse engines, ranging from 600 horse-power down to twelve and one-half horse-power, and aggregating a capacity of almost 8,000 horse-power. They were all of the vertical, single-acting type, both simple and compound. The list of customers comprises government arsenals, railroads, electric light companies, bureau waterworks, mines, universities and hospitals. Among the more important orders filed were the following: Akabane arsenal, 1,950 horse-power; Kure and Tokio arsenals, 1,628 horse-power; Kiushiu and Nippon railways, 579 horse-power; Yokoska arsenal, 547 horse-power; Fukagawa and Tokio Electric Light companies, 450 horse-power; Mr. Furukawa's Western Bureau, 1,265 horse-power; Tokio Imperial University, 93 horse-power; Yokohama Electric Wire Works, 62 horse-power; Tokio waterworks, 31 horse-power.

THE STANLEY INSTRUMENT COMPANY, Great Barrington, Mass., is mailing a circular letter concerning the manufacture of its model H rotated jewel-bearing wattmeters. This circular states that eminent counsel have declared that, in their opinion, the model H-6 rotated jewel-bearing wattmeters are not only outside of any valid claim of infringement of the Tesla patents Nos. 511,559 and 511,560, but are in exact conformity with the suggestion contained in the opinion of the United States Circuit Court of Appeals for the First District, filed September 9, 1904, which states: "If the device stopped with a 'metallic rotating body,' and some method other than a counting-machine operated by it was used for determining the number of its revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent, that a mere meter is in a different art from a motor; but as it does not stop there we must look further." The company states that on and after June 21 it will be prepared to, and will, fill all orders in hand or received thereafter for this wattmeter.